U.S. ARMY ENVIRONMENTAL CENTER

ABERDEEN PROVING GROUND
MARYLAND 21010-5401

PRELIMINARY ASSESSMENT REPORT
U.S. ARMY RESERVE CENTER,
MANITOWOC, WISCONSIN

FINAL REPORT

DECEMBER 1993

ECG, INC.
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PRELIMINARY ASSESSMENT REPORT

for

U.S. ARMY RESERVE CENTER, MANITOWOC, WISCONSIN

FINAL REPORT
of
December 20, 1993

Prepared for:
U.S. Army Environmental Center
Aberdeen Proving Ground
Maryland 21010-5401

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13. ABSTRACT *(Maximum 200 words)*

A Preliminary Assessment (PA) was conducted at the U.S. Army Reserve Center, Manitowoc, Wisconsin (MARC) to evaluate site conditions and the potential for hazardous materials migration and contamination exposure to surrounding environs. To accomplish this task, records were reviewed, an on-site inspection was conducted, and interviews were conducted with present and past personnel at the MARC and with local and state regulatory personnel. No sampling activities were conducted, but past sampling records were reviewed.

The operations at MARC require the handling of some hazardous materials/hazardous wastes (HM/HW). Past HM/HW handling practices resulted in a contaminated dry well which was cleaned up in 1992. Results of the two Site Investigations indicate that the trichloroethylene (TCE) which has been found in a nearby public water supply well is not emanating from the MARC site. No other past or present operations at the MARC appear likely to pose a threat to public health and welfare or the environment.

It is therefore recommended that the U.S. Army take the necessary steps for site closeout of the MARC from the IRP.

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EXECUTIVE SUMMARY

A Preliminary Assessment (PA) was conducted at the U.S. Army Reserve Center, Manitowoc, Wisconsin (MARC). This report (prepared by ECG, Inc. of Vienna, Virginia under Contract No. DACA31-93-P-1656 with the USAED, Baltimore, MD) represents the findings of that PA. The PA was performed under the U.S. Army Installation Restoration Program (IRP) in accordance with the guidance for that program and subject to the Comprehensive Environmental Restoration Compensation and Liability Act (CERCLA; 1980 as amended).

This PA gathered information to evaluate site conditions and the potential for hazardous materials migration and contamination exposure to surrounding environs. To accomplish this task, records were reviewed, an on-site inspection was conducted, and interviews were conducted with present and past personnel at the MARC and with local and state regulatory personnel. While sampling activities were not conducted as part of this PA, past sampling records were reviewed.

Findings: The operations at MARC require the handling of some hazardous materials/hazardous wastes (HM/HW). Past and present activities involving HM/HW include: vehicle maintenance; storage of waste oils and antifreeze in above-ground storage tanks; storage of paint products on-site; storage of small quantities of petroleum products and solvents in a POL shed and in a flammable resistant shed; past use of a grease pit in the motor vehicle maintenance building; and past use of a large vehicle wash rack with attached dry well.

- Past HM/HW handling practices resulted in a contaminated dry well. This well was cleaned up to State standards in 1992 by Foth & Van Dyke under contract to the U.S. Army.[1]

- Results of the two Site Investigations indicate that the trichloroethylene (TCE) which has been found in a nearby public water supply well is not emanating from the MARC site.[2,3]

- No other past or present operations at the MARC appear likely to pose a threat to public health and welfare or the environment.

Recommendations: It is therefore recommended that the U.S. Army (MARC, USARC or USAEC) take the following steps to achieve site closeout at the MARC:

1. Prepare a Decision Document demonstrating that the MARC is not the source of the TCE contamination found at the deep aquifer Collector "B" well.

2. Seek concurrence on the above Decision Document by federal, state and local regulatory agencies (EPA, WDNR, and MPU, respectively).

3. Improve the HM/HW handling procedures used by MARC personnel at the POL shed, in the waste storage tanks adjacent to the POL shed, and in the storage of antifreeze and any other hazardous materials in the Drill Hall.

4. Complete all site closeout steps including notifications and documentation removing the MARC from the IRP.

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SECTION 1
STUDY DESCRIPTION

1.1 Work Assignment

This Preliminary Assessment (PA) Report for the Manitowoc U.S. Army Reserve Center (MARC) was prepared by ECG, Inc. of Vienna, Virginia under Contract No. DACA31-93-P-1656 with the USAED, Baltimore, MD. The PA was prepared for the U.S. Army Environmental Center (USAEC), Aberdeen Proving Ground, MD. The USAEC Work Assignment Managers for the USAEC were Franklin Hoffman and Janet Beavers. The ECG, Inc. study team included Mark Pape (Project Manager) and Eric Zelsdorf.

1.2 Purpose

The purposes of this PA were to:

- Determine which, if any, sites on the MARC facility have released or may release hazardous substances (contamination);
- Determine the type, magnitude and potential threat to human health, welfare and/or the environment of these releases;
- Recommend site closeout for those sites which do not pose a threat;
- Recommend subsequent response activities for those sites which do pose a threat;
- Furnish appropriate information about the site for future investigations or remediations.

1.3 Scope

The scope of this Preliminary Assessment Report is limited to consideration of the real and potential releases of contamination released from the MARC. No sampling was done as part of this assessment. Contamination sources outside the MARC are not within the scope of this report.

Specifically, a contamination problem has been reported downgradient from the MARC at Collector "B" of the Manitowoc public water supply. The potential for MARC to be the source of this contamination is reviewed in this report. However, the other potential sources of the TCE contamination are not considered within this report.

1.4 Methodology

This PA was conducted under the U.S. Army Installation Restoration Program (IRP). As such it has been conducted in accordance with the "U.S. Army Installation Restoration Program Guidance Manual" (10/93). Because the IRP is subject to the requirements of the Comprehensive Environmental Restoration Compensation and Liability Act (CERCLA; 1980 as amended), this study also met the requirements of, "Guidance for Performing Preliminary Assessments Under CERCLA," USEPA, 1991.

The principal actions taken within this assessment included:

- Kickoff meeting with COR and collection of existing reports from USAEC (10/8/93);
- Interview current and retired personnel at MARC, and public officials for City of Manitowoc and Manitowoc Public Utilities (10/25 and 26/93) as follows;

Table 1-1: Persons Interviewed in Manitowoc Site Visit

Person Interviewed	Position
Chuck Herzog, Jim Krowiz	Assistant Chiefs of Manitowoc Fire Dept.
Nicholas Levendusky	Deputy Planner, Manitowoc City Planning Dept.
Mike Hawley	Manitowoc City Engineer
Nilaksh Khotar	Water Dept. Manager, Manitowoc Public Utilities
Colleen Reilly	Environmental Manager, HQ 86th ARCOM
Nannette Groll	MARC Facility Coordinator, Unit Administrator - 377th Maintenance Company
Robert Steffen	Former MARC Facility Coordinator (1968-1992)
Sgt. Richard Nason	MARC Maintenance Control Officer, Environmental Coordinator (4/93-present)
Jim Aasen	Manitowoc Office, Wisconsin Department of Natural Resources (WDNR)
Terry Koehn	Madison Office, WDNR

- Conduct perimeter inspection and on-site reconnaissance, take photographs for record of potential contamination sources/sites (10/26/93);
- Review existing reports and records;

- Prepare Draft Preliminary Assessment Report (11/12/93), and on basis of comments prepare final Preliminary Assessment Report (12/20/93).

1.5 Prior IRP-Related Activities

The MARC has been the subject of interest as a potential contamination source for trichlorethylene (TCE) which has been found downgradient at Collector "B" for the Manitowoc Public Water Utility. As a result, a series of studies and actions have already taken place relating to the MARC.

Principal IRP-related actions to date include:

1) The Wisconsin Department of Natural Resources (WDNR) identified MARC as a potential source of TCE contamination found at Collector "B" (Memorandum of 10/12/87 by WDNR hydrogeologist, Jeff Haack).[4] On this basis, WDNR presented MARC with a Notification of Non-Compliance (5/4/88).

2) The U.S. Army Reserve (USAR) sent two environmental protection specialists to assess the MARC. Their trip report of 5/25/88 and the associated Hazardous Waste Site Report of 3/3/89 identified eight (8) potential sources of contamination. The trip report has been used as the Initial Installation Assessment (IIA) or Preliminary Assessment for MARC.

3) The USAR conducted a Site Investigation in 1989 and 1990 to determine which if any potential sources on the MARC might have contributed to the TCE contamination at Collector "B". The final report, "Site Investigation Manitowoc Army Reserve Center," August 1990 was prepared by E.C. Jordan Company for USATHAMA.

4) Based on issues and ongoing concerns from the Site Investigation Report by WDNR, the Army conducted a follow-on Site Investigation. The final report, "Follow-On Site Investigation, Manitowoc Army Reserve Center," August 1992 was prepared by OHM Corporation.

These reports and the actions and critical correspondence associated with them are discussed in this report. Appendix C shows the critical correspondence from these prior studies and actions.

SECTION 2
INSTALLATION DESCRIPTION

2.1 Operational History

The Manitowoc Army Reserve Center (MARC) is a United States Army Reserves (USAR) troop training center, located in Manitowoc, Wisconsin. MARC was established in 1958, as a military training center for reserve troops. The 5-acre property on which the MARC stands was leased at that time for a period of 99 years from the city of Manitowoc.

The MARC housed units of the 84th Training Division from its inception in 1958 until October of 1993. The MARC has housed the 86th ARCOM, 377th Maintenance Company from 1958 until the present. The 84th Training Division and 86th ARCOM units were collocated at the MARC until October 1993 when the 84th moved out to the Army Reserve Center, Sheboygan, Wisconsin.

Both units perform drills and field exercises at Fort McCoy or other locations off of the Center's grounds. No units performed field exercises on the MARC property during the 84th Division occupation. Further, the Center has no rifle range or other firing or testing of weapons on the property.

The unit currently occupying the MARC is designated a maintenance unit which conducts limited vehicle maintenance, generator repair, and minor electronic maintenance work. In addition to the 84th Division and 86th ARCOM unit's activities, the Training Support Brigade, headquartered in Milwaukee, occasionally performed vehicle maintenance at the MARC prior to October 1993. Small scale industrial operations are performed on the site related primarily to the servicing and maintenance of U.S. Army trucks, jeeps, and occasionally, armored combat vehicles.

The center is currently storing several truckloads of dry goods including tents, clothes, tools, etc., for the 84th Division and 86th ARCOM.

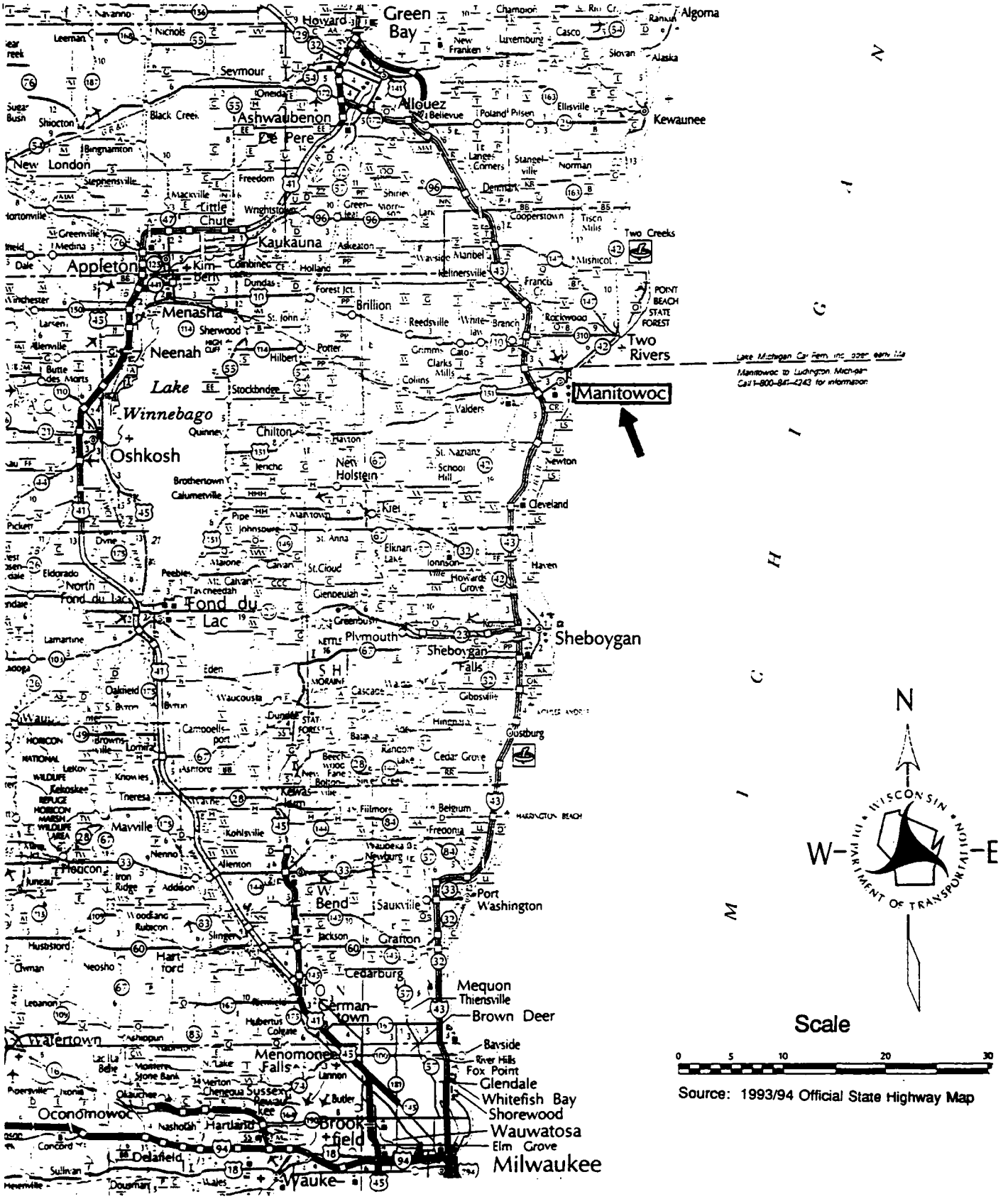
The MARC has not been assigned a CERCLA Information System (CERCLIS) identification number. The installation has been assigned an EPA identification number of WI-8210-49-0217.

2.2 Physical Characteristics

2.2.1 Location and Size

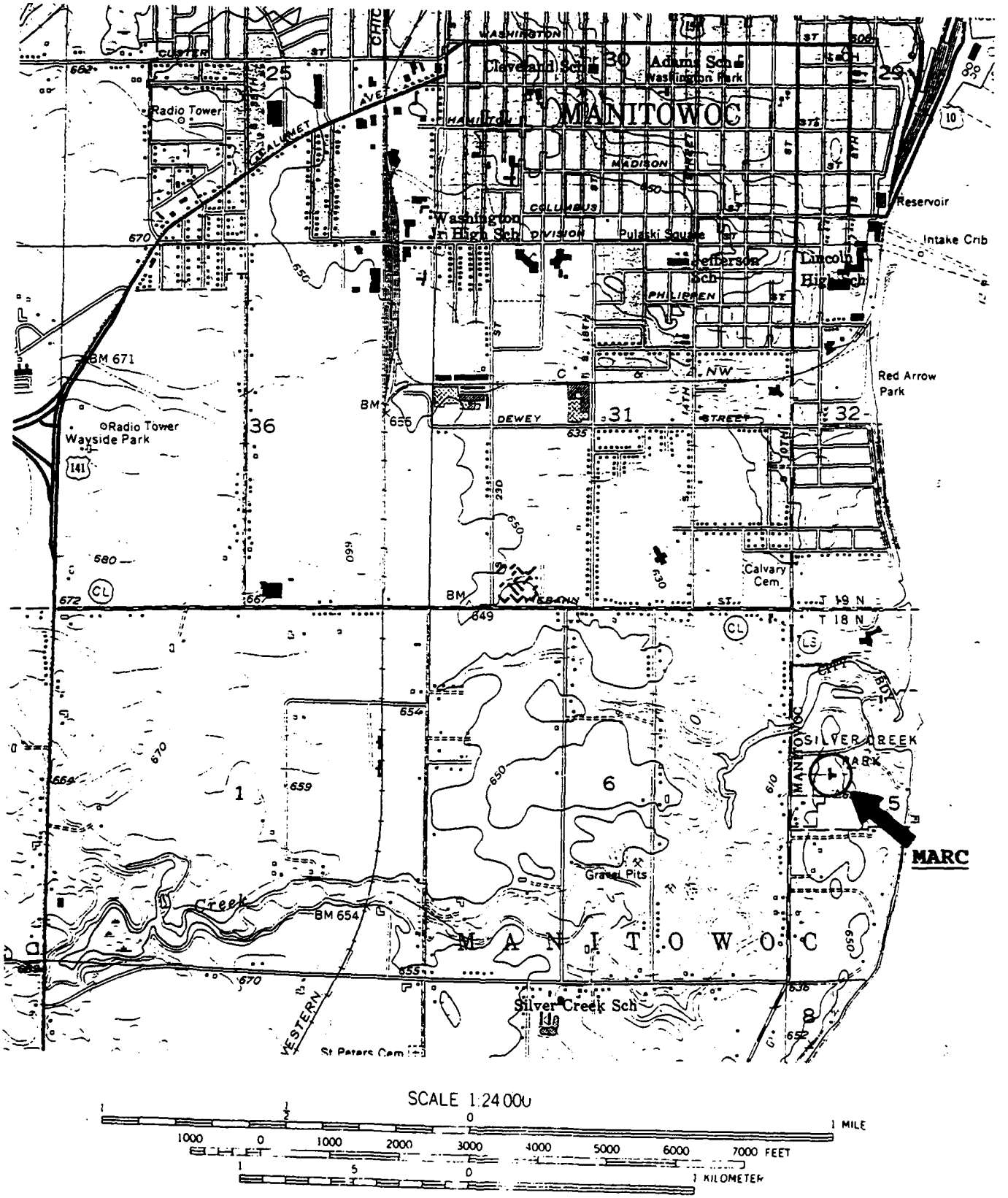
The USARC Manitowoc (MARC) is in east-central Wisconsin, 80 miles north of Milwaukee and 35 miles southeast of Green Bay on the western shore of Lake Michigan (Figures 2-1 and 2-2). The MARC is located on approximately five square acres on a small hill surrounded by Silver Creek Park. Its geographic coordinates are 44° 02' 30" N latitude and 87° 37' 30" W longitude. (Figure 2-2). It is just inside the southeast city limit of Manitowoc, Wisconsin in Manitowoc County at 3125 South 10th Street, Manitowoc, Wisconsin.

Figure 2-1: Location of Manitowoc, Wisconsin



Source: 1993/94 Official State Highway Map

Figure 2-2: Location of Manitowoc Army Reserve Center



Source: USGS 7.5 Minute Series Topographic Map; Manitowoc Quadrangle

To reach the site, travel south from city of Manitowoc on 10th Street for approximately 0.5 mile, and turn left on the access road to Silver Creek Park. The site is approximately 250 feet on the right side of the access road.

2.2.2 Physical Structures

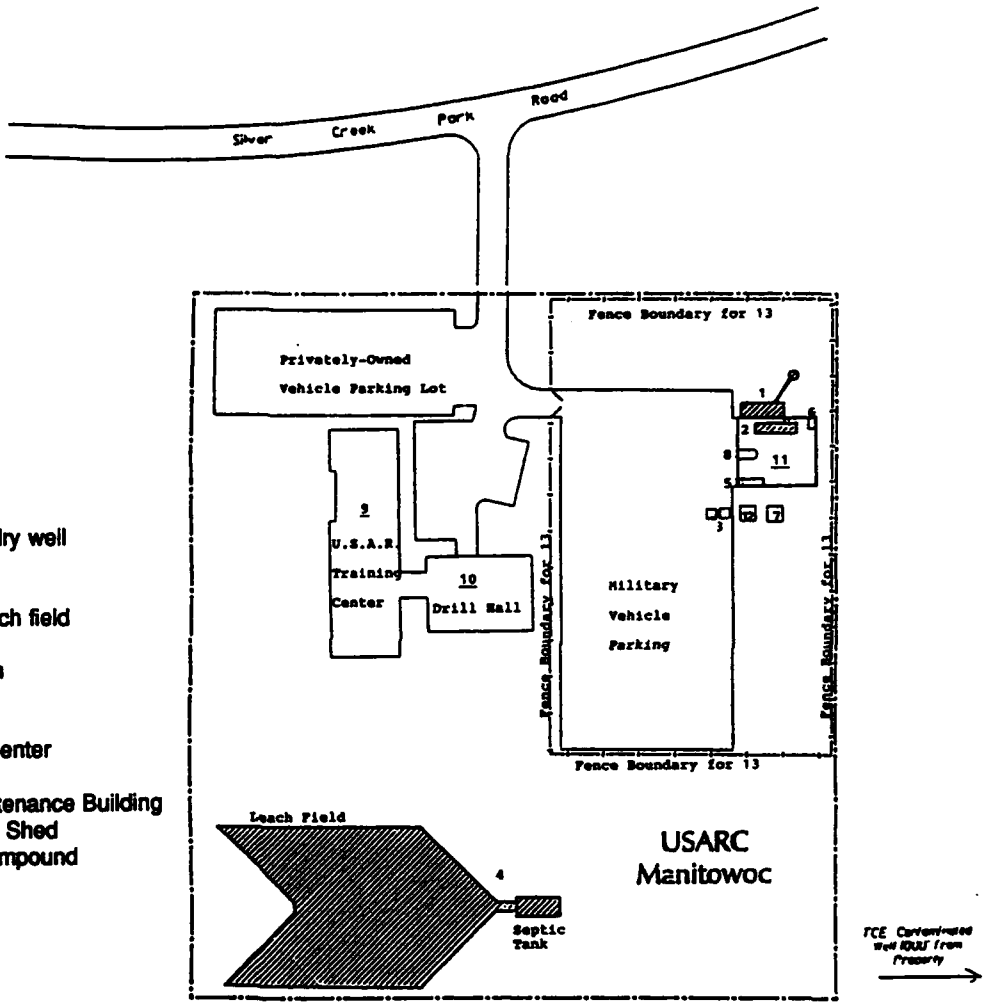
A visual inspection of the Center, along with a review of Center records and interviews with Center personnel, resulted in the identification of specific sites on the property. Though the MARC facility is relatively small, several structures are contained within its boundaries. Many of the structures are benign in terms of potential polluting sources. Listed below are the structures contained on the MARC property which were of potential concern to this study. This list includes the existing site I.D. numbers (as identified in USATHAMA Waste Site Report of 3/3/89):

Table 2-1: Structures Considered in Review

Structure	Prior IRP Site ID
Vehicle wash rack/dry well	1
Grease pit	2
Waste oil storage	3
Septic tank with leach field	4
Parts Cleaner	5
Paint Storage Room	6
POL Storage Shed	7
Battery area	8
U.S.A.R. Training Center	-
Drill Hall	-
Motor Vehicle Maintenance Building	-
Flammable Storage Shed	-
Vehicle Storage Compound	-

The relative position of these structures on the MARC are shown in Figure 2-3. These structures are discussed in Section 3 regarding their waste generation potential.

Figure 2-3: Relative Location of Sites and Structures on MARC



1 Vehicle wash rack/dry well
2 Grease pit
3 Waste oil storage
4 Septic tank with leach field
5 Parts Cleaner
6 Paint Storage Room
7 POL Storage Shed
8 Battery area
9 U.S.A.R. Training Center
10 Drill Hall
11 Motor Vehicle Maintenance Building
12 Flammable Storage Shed
13 Vehicle Storage Compound

Drawing Not to Scale

2.3 Population

2.3.1 MARC Population Estimates

The MARC has no residential staff. It's assigned personnel strength consists of a permanent full-time staff of eight (8), and a part-time staff of 200 Army Reservists. This is typical of a reserve center. The population estimate for MARC is completely independent of the local population (i.e., the city of Manitowoc).

The 84th Division Field Artillery Training Committee was smaller than the 377th Maintenance Company. The former had approximately 80 people and maintained two howitzers and one or two 2.5 ton trucks. This size was estimated to have been fairly consistent from 1968 to 1993, according to the facility coordinator for that time period.

2.3.2 Local Population

The population within a four mile radius of MARC is estimated to be 32,000, based on Manitowoc planning officials review of 1990 census population maps. This radius includes almost all of the City of Manitowoc to the north and west and the lower density areas to the west and south. A windshield survey along 10th Street to the south of the MARC indicated 93 houses (approximately 360 people) within 4 miles. Assuming that the 10th Street survey represented a 0.5 mile swath gives a population density of 180 people per square mile. If this density is representatives of the area south of the Manitowoc city boundaries, approximately 1,500 people live in this southeastern quadrant.

Planning officials indicated that the local population has been very stable for over the past two decades.

2.4 Environmental Setting

2.4.1 Surrounding Land Use

The MARC is located within the boundaries of Silver Creek Park (Figure 2-2). The nearest residences are approximately one quarter of a mile away. Immediately surrounding MARC to the west and south are residential and farm properties. To the north of the MARC is the City of Manitowoc, including residential, school, recreational, commercial, industrial and agricultural land uses.

2.4.2 Surrounding Populations

As noted above, the population surrounding MARC includes approximately 32,000 in the City of Manitowoc plus approximately 1,500 people to the south of Manitowoc, but within a four mile radius of the MARC.

2.4.3 Meteorology

Manitowoc County is characterized by mild summer and cold winter temperatures. Summers are typically warm with mean maximum temperatures around 80°F and high temperatures occasionally exceeding 90°F. Winter months are cold, with mean maximum daily temperatures around 30°F and daily temperatures typically in lower teens. Mean annual precipitation is around 30 inches (NOAA Annual Climatological Summary, 1973 to 1992; included as Appendix D).

2.4.4 Geology

Manitowoc County, located in eastern Wisconsin, is situated on the western shore of Lake Michigan. Lake Michigan, formed by glaciation during the Pleistocene epoch, is the third largest of the Great lakes and is located between Wisconsin and Michigan.

Regional Geology: The deposits of the Manitowoc area are brown to reddish-brown calcareous till with variable amounts of sand, silt, and clay. This is characteristic of the Kewaunee Formation (i.e., left from the withdrawal of the Keewatin Ice Sheet or glacier). The Valders, Haven, and one undifferentiated till of the Kewaunee Formation are exposed along the Lake Michigan shoreline bluff in the Manitowoc area. Some lake bed sediments, presumably from glacial Lake Chicago, can also be found in the exposed shoreline bluff.

The underlying bedrock in the Manitowoc region is from the third period of the Paleozoic era, the Silurian age; a period characterized by the appearance of land plants[6]. Light colored dolomite, a mineral similar to limestone, from this era makes up the bedrock which ranges in thickness from 300 to 700 feet.[5]

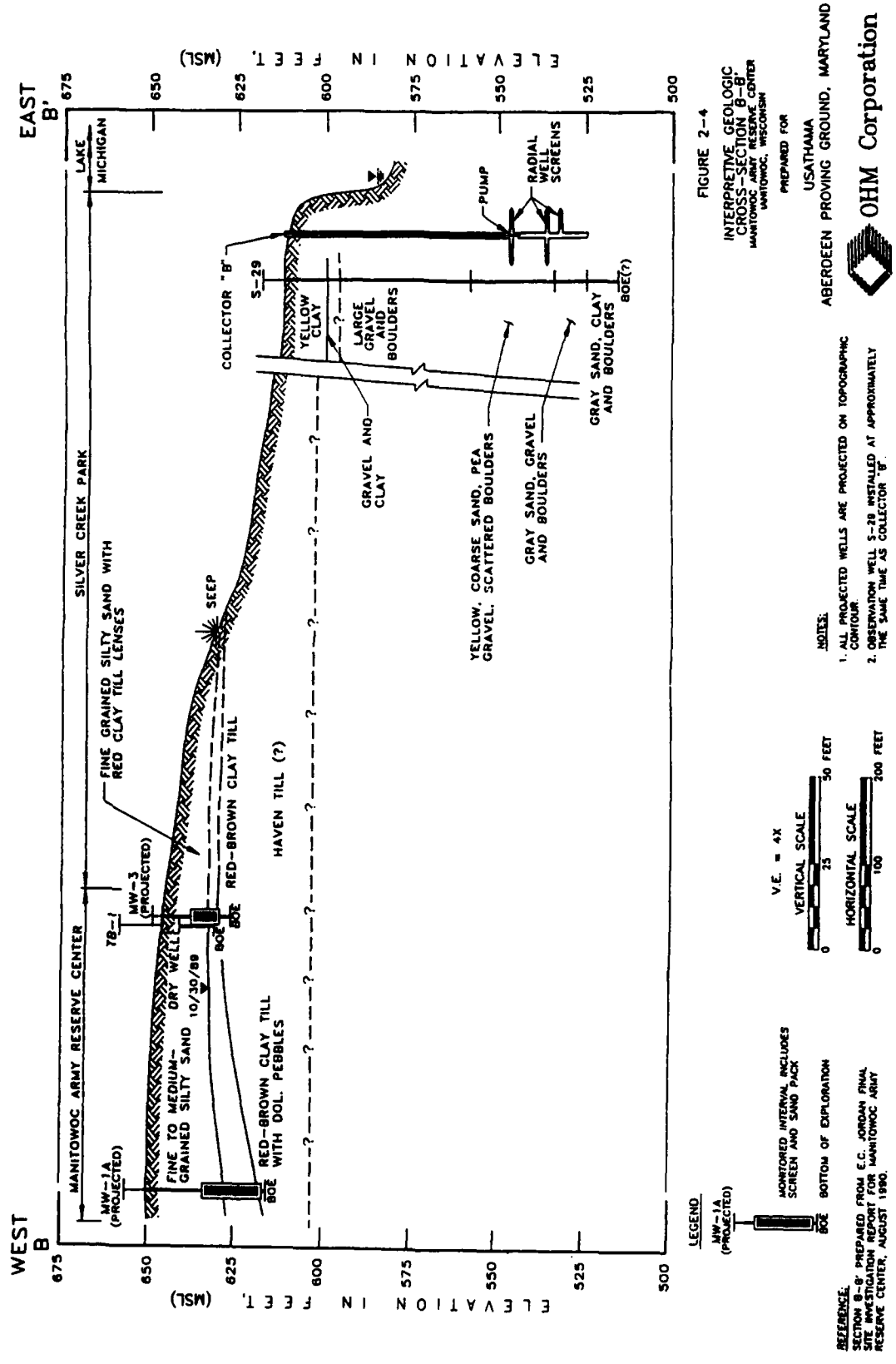
Site Geology: The site is about 1000 feet west of Lake Michigan. It is approximately 650 feet above mean sea level (MSL), and 70 feet above the mean elevation of the lake. Site geological stratification includes a series of glacial and lake bed sediments. Figure 2-4 shows a cross section of the local geology between the MARC and Collector "B" at Lake Michigan.

Observed stratigraphic evidence from a previous site investigation reveal three discrete stratum or layers beneath the reserve center.[2,3] The first layer is fine- to medium-grain silty sand which varies in thickness from fifteen to thirty-five feet and rests atop a moderately to highly plastic clay till.

The clay till contains some Silurian age dolomite pebbles and acts as an aquitard, creating locally perched aquifers. While this clay layer is initially damp, it is relatively impermeable and becomes dry as the depth increases. This layer is believed to be the Haven Till from the Kewaunee Formation.[2,3]

Below the clay till layer lies a fine to medium uniform sand which contains traces of silt.

Figure 2-4: Cross Section of Local Geology at the MARC



2.4.5 Hydrogeology

Regional Hydrogeology: In general, Manitowoc area groundwater flows from recharge areas or higher, inland elevations, toward lower elevations where it discharges into streams, wetlands, and Lake Michigan.[5] The geology underlying the Manitowoc area is primarily lake deposits containing beach sand. Collector wells run by the City of Manitowoc have achieved maximum yields of 5500 gallons per minute.[5]

Site-Specific Hydrogeology: A previous site investigation at MARC by E.C. Jordan encountered groundwater in borings in all layers of the underlying stratum including the sand layer and the first several feet of the clay till. The clay till creates a locally contained aquifer system by acting as an aquitard. Recharge of this local system is believed to occur as a result of precipitation. Discharge from this aquifer occurs as seeps which follow a north-south path along the steeply sloped eastern side of the MARC property.

The facility is not located in a 100 or 500 year flood plain, according to flood insurance rate map provided by the Federal Emergency Management Agency (FEMA).[7]

2.5 Local Water Use

2.5.1 Public Wells

Manitowoc Public Utilities drinking water sources include a Lake Michigan water intake located approximately two miles east of Manitowoc and three groundwater collectors wells ("A," "B" and "C") located in the deeper aquifer underlying Manitowoc. Each Ranney collector consists of a large diameter caisson set in the ground to a depth in the aquifer required for efficient hydraulic pressure. Screens protrude radially from the caisson into the aquifer. The city currently uses collector "C" regularly to avoid stagnation in what would otherwise be a long "dead-leg" water main. Collectors "A" and "B" are on permanent standby and collector "B" is to be used in emergencies only. These collectors are recharged from both the inland groundwater sources and by groundwater infiltration from Lake Michigan. No other cities have public wells within a four mile radius of the MARC.

2.5.2 Private/Residential Wells

Water for locations outside the city limits, including that going to most residences surrounding the MARC is drawn from private wells. These wells are not registered, monitored or maintained by the city or county of Manitowoc. No sampling program exists for these wells and no analytical data are available for review concerning private well systems.

2.5.3 Surface Water Use

The City of Manitowoc, which uses Lake Michigan as a primary raw water source for drinking

water, treats the water at their surface water treatment plant. The Manitowoc Public Utilities (MPU) Water Department Manager indicated that the main intake for the plant is located approximately two miles east of the city, not as close as is described on USGS topographical maps. Current capacity of the lake intake is 6 million gallons per day (mgd). MPU plans are to increase this to 10 mgd.

Silver Creek is used for recreational purposes. Lake Michigan has a full array of uses including drinking water, swimming, boating, commercial and sport fishing, and support of wildlife.

2.6 Critical Habitats/Endangered or Threatened Species

Representatives of WDNR have been contacted, and have indicated that Silver Creek Park and the lands surrounding the MARC, contains no habitat for any species on the current endangered species list. However, Silver Creek, which runs through Silver Creek Park, is heavily fished for lake run fish including Rainbow Trout and Smelt in the spring, and Salmon and Suckers in the fall.

The reserve center is within 200 yards of Silver Creek, and, while the creek is not a critical habitat, any discharge from the center could impact on fish runs from Lake Michigan.

SECTION 3
WASTE GENERATION HISTORY

An on-site reconnaissance of the MARC was conducted on October 26, 1993 by members of the ECG team in conjunction with Colleen Reilly, Environmental Manager for 86th ARCOM. This visit, in conjunction with the prior reports for the MARC, formed the basis for the following site descriptions. These descriptions have been organized by the site I.D. numbers assigned within the Hazardous Waste Site Report (3/3/89). Five additional structures are considered as candidate sites, as discussed in sections 3.1.9 through 3.1.13.

3.1 Vehicle/Equipment Wash Rack and Dry Well

A motor vehicle wash rack is on the north side of and adjacent to the motor vehicle storage building. The rack consists of a concrete pad approximately 20 feet by 10 feet square and slightly sloping toward the center for drainage purposes. The wash rack drained to a dry well located approximately 25 feet to the northeast of the wash rack.

The dry well was excavated and filled in 1991-92 and is no longer operational. Though the wash rack has not been used for several years, a previous USATHAMA records search for MARC, performed by E.C. Jordan, indicated that the unit was used to service approximately 70 vehicles per year. Analytical data obtained during the excavation process showed no detectable amounts of diesel fuel or other hydrocarbons. No analyses were performed for other compound types. Current practice is to leave a large vehicle parked over the pad to prevent use of the rack.

3.2 Grease Pit

Formerly located in the northwest corner of the motor vehicle maintenance building, this concrete-lined pit was used to change oil and other fluids during vehicle maintenance. The Facility Management Officer for Headquarters, 86th ARCOM reports the following:

> "Site plans of the grease pit indicate no drains or pipes to the [leach field] septic tank. A concrete oil receptor (2 feet x 12 inches x 8 inches), covered with a metal grate, was located in the bottom of the pit to collect any spills that did occur. This receptor was pumped out prior to closure of the pit. These pits were used in lieu of a lift for the vehicles, such that they parked the vehicle over the pit where the maintenance personnel would stand to grease the vehicles and to change oil. The oil was drained into a drum, not into the bottom of the pit. No analytical sampling was conducted on the pit prior to closure."[8]

The pit was filled in and capped with concrete in 1978.

3.3 Waste Oil Storage

Previous site investigations indicated three metal or plastic drums stored next to the POL storage shed were used to store waste oil, solvents, and antifreeze (ethylene glycol). These containers have since been removed. Currently there are two large (400 gallon) metal waste storage containers outside the new hazardous waste storage facility; one is used for waste oil and the other is used for waste antifreeze. The oil container had less than 100 gallons of spent oil which was collected over a six month period. The ethylene glycol container had less than 80 gallons of material collected over a six month period. The center is not required to dispose wastes within ninety days since it is not a large quantity generator as defined by RCRA. The center has plans to replace these containers in the near future.

3.4 Septic Tank and Leaching Field

The septic tank with leach field system, installed in 1960, is located at the south end of the complex and consists of a holding tank, pumphouse, and tile leach field arranged in a herringbone pattern. The holding tank capacity is estimated to be less than 20,000 gallons. The field is well ventilated with at least fifteen vent pipes. According to MARC personnel, only human wastes are processed through this system. No known disposal of chemicals or petroleum products has been documented. The tank had been emptied once (date unknown) to repair for corrosion.

The city of Manitowoc has recently constructed a sewer trunk line out 10th street. The MARC may tie in to this sewer, eliminating the need for the septic tank and leaching field.

3.5 Parts Cleaner

A small (less than 5 gallon capacity) parts cleaner is located in the southwest corner of the motor vehicle maintenance building. The device is maintained by Safety Kleen and is stored and used directly under a ventilation hood. The area immediately surrounding the device was dry and showed no evidence of spills or leaks of material. The floor is concrete with no floor drains, so leaks or spills will be relatively contained.

3.6 Paint Storage Room

The paint storage room is a small room located in the northeast corner of the motor vehicle maintenance building. The room is inaccessible from inside the building but has a door on the north side which opens to a grassy area. The room has a concrete floor with no floor drain. There is a small curb at the door which would prevent spills from escaping. The room is used to store small (less than five gallon) containers of paint and/or paint thinner. The total paint quantity stored in the room was estimated as 20 gallons in 1989. No reports of spills were received for the room.

This room was not inspected during the October 26, 1993 site visit because the keys for entry had been misplaced. The room does not appear to pose a threat to the environment, because it is in an enclosed, undrained room with a concrete foundation.

3.7 POL Storage Shed

The POL storage shed is an 8-by-10-foot corrugated metal structure located to the south of the motor vehicle maintenance building. The shed has an asphalt floor and no drainage. The shed is currently used for storing lubricants, motor oils, non-halogenated solvents (e.g., xylene), small quantities of waste oil, and empty, small quantity, metallic storage containers. The floor of the shed, while paved, is excessively dirty; it is covered approximately three inches deep with blackened, oily, soil, indicative of historically poor handling and storage practices within the shed.

The materials in the POL Storage Shed were stored on shelves or on wooden pallets. Some of the containers were past their expiration date and should be disposed via the appropriate DRMO (Defense Reutilization and Marketing Office).

3.8 Battery Area

Approximately fifteen batteries are currently stored in the middle of the motor vehicle maintenance building, between the motor vehicle entry doors. MARC personnel indicated that batteries were recharged and subsequently stored for periods of time due to the threat of theft from unattended vehicles. A 2-gallon container of acid is stored for occasional use. The maintenance control officer indicated that batteries were to be moved back into the vehicles instead of being stored.

3.9 U.S.A.R. Training Center

The Training Center is the primary building on the Reserve Center site. It is located to the southwest of the entry to the MARC from Silver Creek Park Road. The building is 50-by-170 feet and is used primarily for office space. The structure does not store or contain significant quantities of hazardous waste/hazardous material.

3.10 Drill Hall

The Drill Hall is at the southwest corner of the Training Center, and is connected to the Training Center by means of a short (20 feet) hallway. The southern part of the drill hall is comprised of several rooms used for storage. The northern part of the building appears to be a shipping/receiving room. On the day of the site visit, a crate of antifreeze was being temporarily stored within the building along with several crates of dry goods. The maintenance officer indicated that these would be moved back to the Maintenance Shop for storage.

A sign for radioactive materials was noted in the Drill Hall. This concerns low-level radioactive materials used in the metering of radiation detection units. According to the maintenance officer, these radiation detection units are stored separately in an approved/locked room within the Drill Hall. The room was not inspected within this PA. The proper maintenance and inspection of the room in accordance with Army regulation is considered to minimize any threat that could potentially be posed by the materials stored within the room.

3.11 Motor Vehicle Maintenance Building

The motor vehicle maintenance building is located in the northeast quadrant of the fenced-in Vehicle Storage Compound. The motor vehicle maintenance building is used for servicing and maintaining U.S. Army vehicles. The building contains two large vehicle bays for maintenance. The maintenance officer indicated that only one vehicle at a time is docked inside and vehicular maintenance is done only sparsely. The building currently contains several drums for disposing of trash; a few 55 gallon drums of lubricant; a parts cleaner, located directly under a fume hood, serviced and maintained by Safety Kleen; a battery charging area consisting of about 15 automotive batteries on a cardboard surface; some electrical generators; a paint storage room; and sundry tools and equipment.

The building sits on a concrete slab foundation with no floor drains or outlets. Previous site investigations reveal the building formerly included a 5-foot-deep grease pit (see Section 3.2).

3.12 Flammable Storage Shed

The flammable storage shed was acquired in 1991 for the purpose of storing petroleum products. The shed is to the west of the POL Storage Shed (see Section 3.7) and to the south of the Motor Vehicle Maintenance Building (see Section 3.11). The shed is an OSHA and RCRA approved flammable materials storage shed and contains brake fluid, enamels, transmission fluid, hydraulic fluid, greases, alcohol, lubricating oil, gear oil, and methanol. All containers appear to be in good condition with no apparent leaks. There is no evidence of spillage or leakage within the shed.

3.13 Vehicle Storage Compound

The Vehicle Storage Compound is a fenced-in area covering approximately 200 feet by 300 feet which is located to the eastern side of the MARC. As many as 100 Army vehicles are stored on the Army Reserve Center's physical grounds (motor pool). The majority of these are utility vehicles; vehicles include light trucks, tractor trailers, etc. There are no tanker trucks or tanker trailers parked on the site. Approximately twenty gas powered electrical generators are stored on the grass inside at the northern end of the fenced in lot. The generators are reportedly received empty from outside supply sources and filled with oils and diesel at the MARC. The majority of the generators appeared new, however, at least one had been filled with fluids and had leaked onto the grass creating a distressed grassy spot directly below.

3.14 Typical HM/HW Sites Not Found at the MARC

With maintenance/industrial operations such as those at the MARC, several other sources of contamination are typically found. A review for these typical sources was performed within this Preliminary Assessment based on past records, interviews with facility coordinators (Steffen and Groll) and a site reconnaissance by the investigation team. The following sources were looked for and not found at the MARC:

- Underground Storage Tanks (USTs) - No USTs were found. Typically these would contain petroleum fuel product or waste oils. All major vehicle fueling, however, is conducted off-base.

- Above-ground Storage Tanks Except for the two 400 gallon tanks used for waste oil and waste antifreeze (noted in Section 3.3), no above-ground tanks are used at the MARC.

- Pesticide Use Pesticide use at the MARC has been minimal according to both Mr. Steffen and Ms. Groll). Only small quantities are used for occasional pest control in the U.S.A.R. Training Center.

- Fire Training Area No fire training is being or has been conducted.

- Firing Range No past or current small arms, rifle or explosive ordnance use.

- Spill Site No major fuel or hazardous materials spills were recalled by either Facility Coordinator.

- Landfill or Waste Pit Other than the dry well discussed in Section 3.1, no above or underground disposal site, landfill or waste pit was recalled by either Facility Coordinator or in evidence on the site visit.

- Oil/Water Separator There has never been an oil/water separator at this facility.

- Industrial Water Treatment or Inputs The leaching field is used only for human waste.

- PCB Equipment According to the persons interviewed, the MARC does not maintain transformers or other equipment which could carry polychlorinated biphenols (PCBs). Two transformers owned by MPU are located on the power lines coming into the MARC. One of these was replaced in approximately 1988 after it had been struck by lightning.

SECTION 4
PAST REGULATORY ACTIVITIES AND RESPONSE ACTIONS

4.1 Trichloroethylene Contamination of MPU Ranney Collector "B"

As noted in Section 2.5, the Manitowoc Public Utilities (MPU) draw the city's drinking water from three deep aquifer collectors ("A," "B," and "C") and from an intake two miles out into Lake Michigan. In 1985, trichloroethylene (TCE) began to show up in the water retrieved from Collector "B," as shown in Table 4.1.

Table 4-1: Manitowoc Ranney Collector "B" Sampling Synopsis - TCE (ug/l) *(from WDNR memorandum of 10/12/87)*

Date	Result	Comments
12-10-85	9.2	initial VOC screen
1-14-86	6.6	run to check 12-10-85 results
10-27-86	6.5	after steam-cleaning
9-29-87	5.7	Nearby private water supply wells of Fischer and Stievater were also sampled. No TCE or VOCs were detected at these private wells.
1-19-88	9.4	3 radial arms open only
3-14-88	5.4	only radial arms to lake open

TCE was confirmed at concentrations above both the WDNR enforcement standard and the Federal Maximum Contaminant Level (MCL) of 5 ug/l. No other Volatile Organic Compounds (VOCs) were detected.

TCE is a volatile, halogenated, organic compound used primarily as a cleaning solvent and as a dry-cleaning fluid in the dry-cleaning industry. Because the MARC property is closer to Collector "B" than any other commercial or industrial operation, the MARC facility became a prime candidate TCE source.

During the pursuit of potential TCE sources, site investigations ruled out many potential suspects. The following discussion explains actions taken to date to determine possible sources of the TCE on the MARC property. The WDNR assigned a Groundwater Contamination Case number (Case #86029) to track the status of remediation concerning this issue. Table 4-2 presents a chronology of these actions.

In order to minimize potential human health risks, MPU has stopped taking in water from its Collector "B." MPU also stopped steam cleaning the collector and changed the lubricant to a

Table 4-2: Chronology of Events Relating to MARC as Potential Source of TCE

1.	10 December 1985 to present	TCE detected in Collector "B." Six samples from 1985 to 1988 showed TCE levels exceeding the MCL. Ongoing samples still shows TCE levels above the MCL.
2.	12 October 1987	Memorandum from Jeffrey Haack (WDNR Area Engineer) to David Hildreth citing the MARC as "the only apparent source of TCE near Collector "B".
3.	4 May 1988	Letter from Mr. Haack to Mr. Steffen (MARC Facility Coordinator), re: Notification of Non-Compliance.
4.	26 May 1988	J. Kenney and L. McIntosh, USARC Environmental Protection Specialists, visit MARC and prepare trip report; considered the Initial Installation Assessment (IIA) under the IRP.
5.	13 June 1988	Lt. Col. Westenburg, Director of Engineering and Housing for Ft. McCoy, responds to Haack letter (Item 3) and agrees with Haack request that MARC install up to four monitoring wells.
6.	September-November 1989; August 1990	Site Investigation of the MARC conducted under USATHAMA contract. Seven monitoring wells installed and soil and groundwater samples taken. Site Investigation Report indicated MARC not source of TCE.
7.	17 July 1990	Letter from R. Stoll (WDNR Hydrogeologist) to USATHAMA provides review comments on Draft Site Investigation Report and requests the Army conduct further investigations of existing and new wells.
8.	July-November 1991; February 1992	USACE contractor conducts follow-on Site Investigation. Five new wells were installed. Groundwater, soil and sediment samples were taken. Follow-on Site Investigation Report concluded MARC not source of TCE.
9.	18 February 1992	Letter from Mr. Stoll to Ms. McIntosh. Agreed with Site Investigation that MARC not source of TCE and recommended WDNR close its investigation of MARC. Requested documents be submitted regarding (i) dry well removal action, and (ii) monitoring wells retention, abandonment or transfer of ownership.
10.	23 March 1992	Letter report by contractor, Foth & Van Dyke, to USARC documenting removal action at dry well site.
11.	23 April 1992; 27 October 1992; 23 November 1992	Correspondence between Lt. Col. Westenburg, Director of Engineering - Ft. McCoy, and Water System Manager, MPU regarding ongoing use of monitoring wells. Decision on their fate is still pending.

food grade lubricant in order to eliminate the well pumps as a possible source of the TCE contamination.

Potential Non-MARC Source of TCE WDNR representatives at both the Manitowoc and Madison offices indicated in telephone conferences in November 1993 that there is currently a major site cleanup at the Town of Newton Dump, located approximately one mile upstream of the MARC. Records from twenty years ago and before have documented that local manufacturing companies dumped barrels of solvents and other industrial processing wastes into a gravel pit at this site. Current, unofficial reports state that benzene, toluene, and xylene have been found in the parts per thousand level, and other compounds are being screened for. This site is very near Silver Creek and upstream from the MARC and the Collector "B." It appears to be a very likely candidate source for the TCE found in Collector "B," though no final determination has been made in this regard.

4.1.1 Motor Vehicle Maintenance Grease Pit

The motor vehicle maintenance building (referred to as the "Reserve Center shop") had contained a grease pit that was filled in and capped with cement in 1978. The IIA (Table 4-2, Item 4) considered the pit as a potential source of groundwater contamination. That report noted that the building design plans did not indicate a floor drain at the bottom. No further discussion or documentation of the grease pit was discovered during record searches and no current Center personnel had direct knowledge of the activities related to it.

4.1.2 Closure of Vehicle Wash Rack/Dry Well

The initial Site Investigation by E.C. Jordan was conducted to determine the source of TCE contamination at MARC, and addressed the potential contribution of pollutants from the dry well.[2] Metals and volatile analyses were conducted on two sediment samples collected from the dry well. Each sediment was analyzed for volatile organic compounds (VOC), total petroleum hydrocarbons (TPH), and metals. Some metals, specifically cadmium, copper, lead, and zinc, were detected at concentrations exceeding background levels. No VOCs were detected. TPHs were detected at the low concentrations (1000 to 1600 ppm) reflective of residual levels from oil and grease residues and were believed to have been a result of motor vehicle cleaning operations. These levels exceed the Wisconsin Department of Natural Resources (WDNR) guidance criteria of 10 ppm. Correspondence between the WDNR and the Commander of USATHAMA, regarding MARC, on July 17, 1990, directed the Army to remove and dispose of all contaminated soils and conduct confirmation analyses on the well, to insure it is free of TPHs, before backfilling with clean dirt. By March of 1992, MARC had fulfilled this directive and complied with the requests of the WDNR. The wash rack and dry well has been out of service since it was backfilled and current practice is to leave a large vehicle parked over the rack to prevent use.

4.1.3 Cleanup of the POL shed

The POL shed was reported in the IIA to rest on a dirt substrate, i.e., without a paved foundation. MARC personnel have subsequently cleaned up this structure to reveal that it does sit atop a paved, bituminous floor. Currently, the floor still has a two to three inch blackened material covering, believed to be contaminated soil or sand. This shed still needs to be addressed and properly cleaned.

Action is now being taken on this shed. The Facility Management Officer for the 86th ARCOM noted, "An additional hazardous material/flammable storage shed has been ordered at time of the PA to replace the existing POL shed. The expected delivery date of this shed is December 28, 1993." [8]

4.1.4 Installation of a Flammable Storage Shed

In 1991 MARC installed a flammable storage shed next to the existing POL shed. This new shed is self contained, has ventilation, and is securable. No TCE or solvents containing TCE were stored in this shed.

4.1.6 Investigation of other potential sources

Several monitoring wells were placed at varied spots and depths in and around the Center's property. Previous investigations monitored ground water from the perched aquifer as well as the saturated sandy level below the aquitard. Only 1,2-dichloroethane was detected near the septic tank leach field, but the levels were right at the laboratory's detection limit suggesting a false positive detection.

There were no apparent signs of distressed vegetation of the type that would occur as a result of dumping solvents or petroleum products onto the ground other than the slowly leaking electrical generator mentioned in 3.13. This observed leak was considered insignificant.

SECTION 5
SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

This Preliminary Assessment (PA) gathered information to evaluate site conditions and the potential for hazardous materials migration and contamination exposure to surrounding environs. To accomplish this task, records were reviewed, an on-site inspection was conducted, interviews were conducted with present and past personnel at the MARC and with local and state regulatory personnel. While sampling activities were not conducted as part of this PA, past sampling records were reviewed.

5.1 Summary of Industrial Activities

The operations at MARC require the normal handling of some hazardous materials/hazardous wastes (HM/HW). The MARC site is still in operation. Past and present activities involving HM/HW include:

- Maintenance of U.S. Army vehicles using indoor bays including light, medium and heavy duty trucks.
- Storage of dry goods including tents, clothing, tools, etc.
- Repair of electronic parts and equipment.
- Storage of waste oil and antifreeze in two 400 gallon above ground storage tanks.
- Storage of paint products in small room within the motor vehicle maintenance building.
- Storage of petroleum products and solvents in a POL shed.
- Storage of petroleum products and solvents in a flammable resistant shed.
- Use of septic tank/leach field system of human waste disposal.
- Past use of grease pit in the motor vehicle maintenance building.
- Past use of vehicle wash rack/dry well to wash large equipment.

Past HM/HW handling practices resulted in a dry well which required cleanup. Other past practices do not seem to have contaminated the environment or put public health and welfare at risk (based on the findings of the two Site Investigations). Current HM/HW handling operations appear to be improved. Several improvements still should be made -- in the POL shed, in the antifreeze storage, and in the waste fluid storage -- but these do not appear to be sources of major uncontrolled contamination.

5.2 Conclusions and Findings

Results of the two Site Investigations indicate that the TCE, found in Collector "B" is not emanating from the MARC site. Analytical data available from previous site investigations did not detect TCE in any of the sampling sites. 1,2-Dichloroethane, which is not a degradation product of TCE, was found near the leach field but at concentrations close to laboratory detection limits.

Visual observations of waste/source areas revealed no areas of major staining or severely stressed vegetation; however, the potential exists for soil contamination adjacent to outdoor source/waste areas from past spills or leaks. The storage of several vehicles on grassy areas within the facility have the potential of leaking engine fluids directly onto the ground and into the locally perched aquifer. However, this type of release would probably be minor.

Municipal wells for the nearby city of Manitowoc water supply, as well as several private wells used for industrial, and domestic use, are present within a 4-mile radius of the site. In addition, sensitive environments are located near the site including Lake Michigan, Silver Creek, Silver Creek Park, and some farmlands; all of which are located in the vicinity and downstream of the site.

5.3 Recommendations

The following recommendations are made on the basis of the site visit, interviews and review of existing reports and correspondence.

The principal concern for the MARC has been whether it is the source of TCE contamination at the Collector "B" used for drinking water supply by the City of Manitowoc. Past investigations by the U.S. Army have resulted in the conclusion that MARC is not the source of this TCE.[2,3] The State of Wisconsin agrees with this conclusion.[9] It is therefore appropriate to close out consideration of the MARC within the IRP.

It is recommended that the U.S. Army (MARC, USARC or USAEC) take the following steps to achieve site closeout at the MARC:

1. Prepare a Decision Document stating that the MARC is not the source of the TCE contamination found at the deep aquifer Collector "B" well.

2. Seek concurrence on the above Decision Document by federal, state and local regulatory agencies (EPA, WDNR, and MPU, respectively). [Note: This concurrence is not strictly required by the laws and regulations of CERCLA or the IRP; without it, however, the site closeout decision will be weaker and more likely to be reconsidered at a later date.]

3. Improve the HM/HW handling procedures used by MARC personnel at the POL shed, in the waste storage tanks adjacent to the POL shed, and in the placement of antifreeze and any other hazardous materials in the Drill Hall.

4. Evaluate MARC personnel training requirements relative to HM/HW handling and spill response. Establish appropriate training programs on the basis of this evaluation.

5. Complete all site closeout steps including notifications and documentation as specified in the U.S. Army Installation Restoration Program Guidance Manual. This action is appropriate once the first three recommendations have been followed. In the worst case, it may also be conducted if only the first action is performed.

REFERENCES

1 Letter Report to David Gundlach, Department of the Army, 1992. Remediation Action Inspection, Manitowoc, Wisconsin. Foth and Van Dyke.

2 U.S. Army Toxic and Hazardous Materials Agency, 1990. Site Investigation. Manitowoc Army Reserve Center, Manitowoc, Wisconsin; Prepared for Agency by E.C. Jordan Co.; Data Item A011.

3 U.S. Army Toxic and Hazardous Materials Agency, 1992. Final Report Follow-On Site Investigation. Manitowoc Army Reserve Center, Manitowoc,Wisconsin; Prepared for Agency by OHM Corporation; Report No. CETHA-IR-CR-92008.

4 Haack, J. October 12, 1987 memorandum to David Hildreth. Subject Groundwater Contamination Case - Manitowoc "B" (Case #86029)

5 Skinner, E.L., and R.G. Borman, 1973. Water Resources of Wisconsin-Lake Michigan Basin; Hydrologic Investigations Atlas HA-432. U.S. Geological Survey, Washington, D.C.

6 Mickelson, D.M. et al., 1984. Pleistocene Stratigraphic Units of Wisconsin; Geological and National History Survey; University of Wisconsin, Madison, Wisconsin; Miscellaneous Paper 84-1.

7 U..S. Federal Insurance Administration, 1977. City of Manitowoc Flood Hazard Boundary Map. Department of Housing and Urban Development. Map H-09.

8 Letter of 15 December, 1993, from Steven R. Shanks, Facility Management Officer, Headquarters, 86th ARCOM to Mark Pape, P.E., ECG, Inc..

9 U.S. Environmental Protection Agency, 1991. Guidance for Performing Preliminary Assessments Under CERCLA. Office of Solid Waste and Emergency Response. Directive 9345.0-01A.

ABBREVIATIONS AND ACRONYMS

AMSA	Area Maintenance Support Activity
ARCOM	U.S. Army Reserve Command
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act (of 1980, as amended)
CERCLIS	CERCLA Information System
COR	Contracting Officer's Representative
DRMO	Defense Reutilization and Marketing Office
FEMA	Federal Emergency Management Agency
IIA	Initial Installation Assessment (predecessor of the Preliminary Assessment)
IRP	Installation Restoration Program
MCL	Maximum Contaminant Level
mg/l	milligrams per liter (equivalent to ppm in water)
MGD	Million Gallons per Day
MPU	Manitowoc Public Utility
MSL	Mean Sea Level
NOAA	National Oceanographic and Atmospheric Administration
OSHA	Occupational Safety and Health Administration
PA	Preliminary Assessment
PCB	PolyChlorinated Biphenols
POL	Petroleum, Oils and Lubricants
ppb	parts per billion
ppm	parts per million
RCRA	Resource Conservation and Recovery Act
SI	Site Inspection
TCE	Trichlorethylene
TPH	Total Petroleum Hydrocarbons
ug/l	micrograms per liter (equivalent to ppb in water)
USAEC	U.S. Army Environmental Center
USAED	U.S. Army Environmental Division
USAR	U.S. Army Reserve
USARC	U.S. Army Reserve Center
MARC	U.S. Army Reserve Center, Manitowoc
USATHAMA	U.S. Army Toxic and Hazardous Material Agency (predecessor to USAEC)
USEPA	U.S. Environmental Protection Agency
USGS	U.S. Geological Survey
VOC	Volatile Organic Compounds
WDNR	Wisconsin Department of Natural Resources

APPENDIX A: FIELD NOTES/LOG

APPENDIX A: FIELD NOTES/LOG

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ENGINEER'S
FIELD BOOK

PRELIMINARY ASSESS
OF MANITOWOC (WI)
ARMY RESERVE CE

No. 8152-3

INDEX

Preliminary Assessment for Manitowoc (WI) Army Reserve Center Oct. '93

Property of MARK PAPE
ECG, Inc.
Address 8150 Leesburg Pike
Vienna, VA
Telephone 703-998-8900

Man.Towoc PA. (1)

WAM - David Hoffman
ECG P.M. - Mark Pope
Junior Professional - Eric Zelsdorf

Prop

Add

Tele

10/25/93 Zelsdorf and Pope
Travelled to City of Man.Towoc
arriving at 1PM.

Owing afternoon visited
The City Hall, Fire Department,
Man.Towoc Public Utilities
and area around MARC
(Man.Towoc Army Reserve Center)

The interviews with personnel
at each of these places (except
MARC) follow

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proc

10/25/93 Mark B. Pope

(6)

Fire Department (within Safety Building 10th & Franklin)

Interviewed Chuck Herzog (Assistant Chief) and Jim Krowiak (Asst. Chief)

Fire Department runs HAZMAT response team that would respond to MARC spills if any.

Mr. Herzog did not recall any HAZMAT calls at MARC. He will review notes/past records. To confirm this and call us back if any found. The HAZMAT response team has been operational for 5 years.

Fire Dept. Keeps UST records No USTs are registered there for MARC. UST records are for 1988 and on. (cont.)

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10/25/93

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Manitowoc Fire Department
Interview ~~complete~~ (continued)

SARA Title II and Toxic Release Inventory data are not kept by Fire Department but by Wisconsin Department of Natural Resources (DNR).

Interview Completed.

10/25/95 /s/ C.B. Ryan

(5)

10/25/95 /s/ C.B. Ryan

(6)

Manitowoc City Hall.

Planning Department
Nicholas Levendusky

- Estimated Population within 4 mile radius of MMRC as 32,000 Based this on quick view of 4 miles limit ~~being~~ including almost all of City of Manitowoc and then lower density areas to west and south.

- The city residents are served by municipal water supply. Residences outside of City limits are on private wells.

- Noted that a landfill existed to west of MMRC, suggested we talk w. engineering about it.

Informal Comp. No.
10/25/93 Mark B. Pope

(7)

10/25/93 Mark B. Pope

(8)

Manitowoc City Hall

Engineering - Mike Holly

- Mr. Holly had mapped out past areas of suspected or known land fills.
- One land fill was shown south of the city limits and west of MARC. He believed it had been used as a dumping site for cinders from the Public Utilities.

- Mr. Holly noted that DNR (Green Bay) would keep listing of hazmat sites

Interview completed.

10/25/93 [signature]

(9)

[signature]

(10)

Manitowoc Public Utilities
Water Dept. Manager
Mr. Nilaksh Kothari, P.E.

- We introduced purpose of the P.A. we are conducting and told of our understanding of the SI's and Collector B findings of TCE.

- Mr. Kother said they Water Department had Tested quality of water at Collector B. TCE was detected at levels below limit of 5 ppb (regulatory). IT was found however that water was not being drawn from West side (MMEC side) of wells. The results may not be fully indicative of WQ. Tests were run during one month of pumping.

- Mr. Kother provided →

(11)

(12)

a schematic of collector systems for the Water Dept. Each of 3 collectors (A, B, C) are horizontal wells drawing some water from Lake Michigan recharge. He stated that current water intake from Lake is located approximately 2 miles east of city — not as shown in USGS Topo map.

- Mr. Kotler requested that a copy of the PA be sent to him. We said distribution would be Army Environmental Center responsibility, but we would tell them of request.

- Collector C is the primary intake. It currently pumps ~6 mgd. Plans are to increase this to 8 to 10 mgd next year.

1/25/95 Mark B. Pyle

(13)

10/25/95 Mark B. Pyle

(14)

Offsite around MARC

- Walked down To Collector B and around eastern area of MARC. No signs of distressed vegetation (though This is too early To rate full leaf cover.)

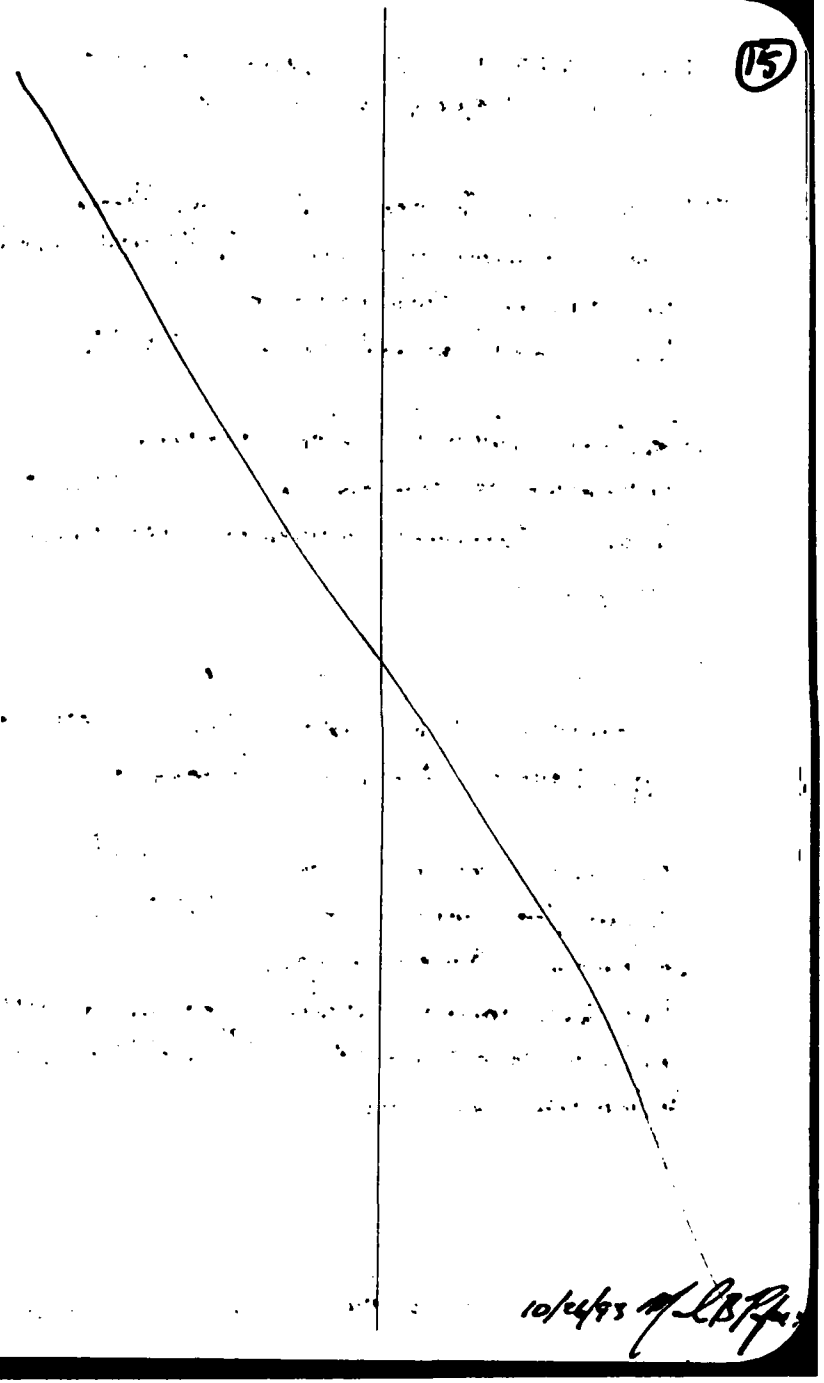
- Performed windshield survey residents counts To south of MARC on 10th street. Found

25	homes	0.0 – 0.6 miles
+ 29	"	0.6 – 1.2 miles
+ 26	"	1.2 – 3.0 miles
+ 13	"	3.0 – 4.0 miles
= 93	Homes	0 – 4.0 miles

Activities completed for day

10/14/93 MJ LBR

(15)



10/14/93 MJ LBR

(16) SITE VISIT TO MANITOWOC ARMY RESERVE CENTER

0900 Met w. Colleen Reilly (Env. Manager, 86th Army Reserve Ctr.) and discussed objectives and existing knowledge on IRP-related activities at MARC.

Ms. Reilly brought files concerning groundwater contamination at MARC (List of Documents reviewed are shown on pg 17.)

Also introduced ourselves to:
Nannette (Nan) Groll, Facility Coordinator
Sgt. Nason, chief of Maintenance

- Ms. Groll noted that the 84th Division just moved off MARC to Sheboygan 3 weeks ago.
- She will contact Robert Steffan, former Facility coordinator 84th ARCOM for interview with us.

10/26/93 [signature] Pape

(17)

The following documents were reviewed and received from MARC on Ms. Reilly:

a) Remediation Action Inspection, Manitowoc, WI, Project HA 000021-05, March 23, 1992 [This was completion report for dry well excavation]
b) MTOE - 377th Maintenance Company 2/9/93
c) Groundwater Contamination Case - Manitowoc "B" correspondence of Oct. 12, 1987
d) WDNR Letter to MARC May 4, 1988 "Notification of Non Compliance"
e) DoA Memorandum of May 10, 1988 re item (d)
f) Manitowoc Trip Report of May 26, 1988 [original Preliminary Assessment]
g) DoA letter to WDNR of June 13, 1988 re item (f)
h) DoA. memo on groundwater investigation June 1, 1989
i) WDNR letter to DoA July 17, 1990 - comments on SI
j) DoA letter to WDNR of July 17, 1991
k) DoA letter to WDNR of Feb 5, 1992
l) WDNR letter to DoA of Feb 18, 1992 [recommending closure of investigation of MARC]
m) DoA to Manitowoc Public Utilities of Oct 27, '92
n) DoA to " " " of April 23, 1992
o) Manitowoc Public Utilities to DoA of Nov 23, 1992

10/26/93 [signature] Pape

(18)

Other correspondences were retrieved at the MARC and considered unnecessary for inclusion in set of copies taken.

Ms. Groth noted that the 84th Div. took some of the center's historical operations documents when they left and would be returning them.

1100 We conducted Telephone interview with Robert Stetten former Facility Coordinator for 84th Division

Ms Groll and Ms. Reilly introduced purpose of study w. Mr. Stetten and then I asked the questions and got history notes from him.

Mr. Stetten started at MARC in December 1968 and worked there until last year (?). Prior to his arrival, Mr. Bill Johnson was Facility Coordinator.

10/26/93 Mark B. Pope

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10/26/93 Mark B. Pope

(20)

- Mr Steffen noted that recycled oils were sent for a while (around 1988) to the city. After that oil and other recyclables were sent to AMSA #51 in Depere, WI.

- The 84th Division was smaller than the 86th Division. IT had 80 people, 2 howitzers (105mm) and 10 or 2 2½ Ton Trucks. This size stayed fairly consistent over the time Mr. Steffen was there.

- Drills/Field Exercises were done either at Fort McCoy or in the country. No exercises were conducted right at MARC.

- No rifle range or firing of weapons was done at MARC.

- In addition to the 84th and 86th the Training Support Brigade (Headquarters in Milwaukee) would do some vehicle maintenance on occasion at MARC

10/26/93 Mark B. Pope

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10/26/93 Mark B. Pope

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Mr. Steffen interview (cont. next)

- Other than 84th and occasional TSB The 377th Company of the 86th would haul all the vehicles, supplies and equipment at the MARC.

- He believes the POL shed was there when he first came to MARC or shortly thereafter. In addition to HAZMAT was also used as holding point for recyclable waste oils, and fluids. — Recalled them being in drums.

- Mr. Steffen did not recall any past practices of solvents or oils being dumped onto the ground.

Mr. Steffen stated there were
- No O/W separators at MARC
- No USTs or ASTs (large)
- No POL storage in large containers (diesel and gas were bought off-base).
- No pesticide use (large scale)

10/26/93 Mark B. Pope

(23)

(24)

- No PCB Transformers that were the Army's. He did, however, know of the 2 Transformers owned by the Public Utilities which come into the MMRC Building. One of these Transformers was replaced approximately 5 years ago when its predecessor was struck by lightning.

- Gypsy Moth spraying has been conducted by the State for the last 2 to 3 years.

- Septic Tank leach field receives just human/domestic wastes. - no tie-in to Vehicle Maintenance yard.

Interview w. Mr. Steffen was completed at 1135.

10/26/93 Mark B. Pope

(25)

10/26/93 Mark B. Pope

(26) Interview w. Nannette Groll

- Ms. Groll is 86th ARCOM 377th [illegible]
  Unit Administrator and Facility
  Administrator for the MARC.
  She has worked there since 1978
  and been Facility Administrator since
  Mr. Steffen left in 1992.

- The 377th unit she works for, and
  the primary occupant of the MARC
  is the 377th Maintenance Company
  DS (Direct Support) of the 86th
  Army Reserve Command (ARCOM)
  This is a 3rd echelon Maintenance unit.
  The 86th is headquartered at Ft. McCoy
  in Sparta, WI.

- The City of Manitowoc owns the land
  that the MARC is on. It is leased
  to the Army for a nominal amount.

- Regarding Recycling of Waste Oils:
  Ms. Groll made arrangements for
  the city to recycle MARC's
  waste oils in the mid 1980's

10/26/93 M. B. Pope

(27)

10/26/93 M. B. Pope

(28) Interview w. Nannette Groll (cont.)

Recycling (cont.)

Ms. Groll's recollection of waste oil handling is

prior to 1985 used AMSA #51
1985-88 used Manitowoc Fire Dept.
1988-90 used AMSA #51 again
1990-present use Safety Kleen (a commercial recycler)

- Washrack and Dry Well — Steam cleaning and hot water washing of vehicles was done at the MMC only until the early 1980's.

We discussed other possible uses of the Dry Well for — e.g. for disposal of waste fluids. Ms. Groll was confident that the well was not being used for such disposal based on her review of the volumes of materials accounted for in their activity reports.

10/26/93 MJ BP

(29)

10/26/93 MJ BP

(30) Interview w. Nannette Groll (cont.)

- Handling of Solvents
  Ms. Groll did not recall any past handling of solvents or other waste liquids where these were drained onto ground or into a floor drain.

- There is no Oil/Water separator on the MARC

- No USTs

- No Hazmats or POL spills recalled

- Pesticide use is minor. She occasionally chases out mice/rodents with small quantities of pesticides.

- The MARC has no PCB Transformers

- Septic tank leach field TAKES only human waste. No input lines from the vehicle maintenance operations

10/26/93 Mark B Pope

(31)

10/26/93 Mark B Pope

(32) Interview w. Nannette Groll (cont.)

- When the 84th moved out last month, they took some of the facility history files which would probably have some of the operational records we were interested in. Repeated attempts to obtain these over the last month have been unsuccessful. While there Ms. Groll called Cindy Richards, Unit Clerk of the 84th to see if Base History & MTOE were available/had been found.
  - They had not. Would keep trying (They need them for their own operations.)
- Interview was completed at 11:55. We broke for lunch

10/26/93 M. B. Pyle

(33)

10/26/93 M. B. Pyle

(34)

Interview and Site Visit w.
Sgt. Richard Nason 1:15pm

- Sgt. Nason has several titles including Maintenance Control Officer and Environmental Control Officer for the 86th. He has been at the MARC since April 1993. He may have up to a 5 year stint — similar to others in his position.

- Vehicle Maintenance — Oil has been changed in the vehicles Two Times since Sgt. Nason has been onboard. These are regularly scheduled changes. The oils get subject to analysis under AOAP (Army Oil Analysis Program)

- As we walked around, with Sgt. Nason and Ms. Reilly, I took photographs of the facility and logged those photos separately. This log is at the end of this report. Photos were taken with disposable cameras.

10/26/93 Mark B Pepe

(35)

10/26/93 Mark B Pepe

Interview w. SgT. Nason / Site V.i.s.T (cont.)

- We walked around full perimeter of the MMRC, past the leaching field and pumphouse, around the outside of the fenced-in Vehicle Storage Area, into the Drill Hall and into and around the full Vehicle Storage Compound.

- SgT. Nason noted that 19 generators had come into the depot for repair. They have been placed in the Northwest corner of the fenced area (photo taken). These generators came in dry (i.e. empty of fluids), so no fluids are likely to leak uncontrolled from them

- SgT. Nason reported no major problems with solvent, POL or antifreeze handling. He did note that Troops needed to be regularly reminded of sound handling practices and he had to correct one Troop for sloppy filling of one tank with gas. Incident after discussion, not considered to have created large spill.

10/26/13 Mark B Pope

10/26/13 Mark B Pope

(38) Interview w. SgT. Mason / Site Visit (cont.)

- Visit To Drill Hall

-- Radioactive warning sign noted inside hall. We were informed This is for radioactive Testing equipment. The equipment is low level radioactive. It is stored in a seperate, well contained and locked cell.

-- several pallettes of containing new antifreeze (5 gallon drums) were being stored in the drill hall. SgT. Mason said this was a Temporary fix for a lack of space in the sheds or Maintenance shop within the fenced in area. While not likely to create a problem, these pallettes should be moved back into the fenced area to minimize the spill potential, the hazard and to maximize the spill response capability

10/26/93 M. B. Pope

(39)

10/26/93 M. B. Pope

Interview w. SgT. Mason / site Visit (cont.)

- When reservists come in on the weekends their drills are oriented toward equipment and vehicle repair.

- Inside the Vehicle Maintenance Shop batteries were noted on the floor between the bays (neatly stored). The batteries are not drained at the MARC. They are handled through AMSA #51.

- Parts Cleaner Unit in SW corner of Maintenance shop. The unit has a Vent Hood. Solvents/cleaners are handled by recycling contractor (Safety Kleen). No MSDS are kept at the parts cleaning unit. These would be useful in case of a spill.

- An eye wash is installed in the shop in case of spills or splashes

10/26/93 M. A. B. Pope

10/26/93 M. A. B. Pope

Interview w. Sgt. Nelson / S.T.O Visit (cont.)

- No floor drains are in place in the maintenance shop. The floor is solid concrete in good condition. If a spill did occur it would be held on the concrete or flow forward out the bay doors onto the paved parking lot. No spills were recalled by Sgt. Nelson.

- The former Grease Pit s.t.o was noted inside the shop. The floor is concreted over at the pit. The outline of the pit is evident.

- Material storage in the shed was orderly. No spills were evident other than normal stains in concrete.

- Waste Oil / Anti-freeze Tanks
  These waste fluids are handled by Safety Kleen. They prepare the manifesting - for MARC personnel (Nelson) to review and sign.

10/26/93 Mark B Peffer

10/26/93 Mark B Peffer

(44)

Interim w. S.T. Nason / S.To V.3.t (cont.)
Ok MBP

Waste Oil/Waste Anti-freeze Tanks, (cont.)

The Tanks need not be emptied every 90 days, since MARC is a small quantity generator.

- Tank sizes 2 400 gallons each
- Since April 1993 (6 months) no emptying of Tanks had been done From a look inside we estimated
  < 100 gal. of waste oil, and
  < 80 gal. of waste anti-freeze had accumulated.

- POL Shed
  - Shed looks dirty but in decent repair. Floor was darkened soils (reported to be paved underneath)
  - Shelving was wooden.
  - Numerous containers noted Hydraulic oils, Xylenes, Anti-freeze Ethylene Glycol Monobutyl Ether, lubricants, Greases, and (2) Oil Drums were seen
  - Some containers looked well beyond their shelf life.

10/26/93 MBP

(45)

10/26/93 MBP

(46)

Interview w. Sgt. Nesen / site visit (cont.)

POL shed (cont.)

- The shed & floor, even if paved may not provide adequate containment of any spilled liquids. The US Army should either properly seal the floor or replace the shed with a contained shed such as the HM storage shed

HM Storage Shed

- located adjacent to POL shed (to west). Much neater, more orderly appearance.
- Contains Brake fluid, Enamels, Transmission Hydraulic Fluid, Compressed Fuel (?), Greases, Alcohol, Lubricating Oil, Gear Oil, Methanol.

- A 1.5 diameter oil stain was noted in front of the sheds

10/16/93

(47)

10/16/93

Interview w. Sgt. Nason / Site Visit (cont.)

- Behind the POL shed (to east) was a vehicle ramp (earthen). This did not appear used in a long time. Sgt. Nason did not believe it had ever been used.

- We continued to walk around vehicle storage compound. No obvious stains or spills, leaks or stains noted from any of the vehicles parked there.

- Fuel truck might house 2 or 3 maintenance units. They have self-contained workshops with virtually all the materials and supplies they would need on operation.

- A tent was set up. Very large where they may set up a winter shop. — if they install a heater and lighting. Had not yet been operational

10/26/93 Mark B. Rose

(50)

- Interview and site visit was completed at 2:30 PM.

- Generally the MARC Facility looked well maintained and orderly. No major new problem areas were evident on the walk around.

Report Collection

Ms. Groll and staff had compiled several sets of documents for us to review. Ms. Reith also showed us the file maintained at her office.

We reviewed these and made photocopies of the relevant ones. Ms. Groll noted again problem of having lost files ✓ To 84th in the move. — These will be returned eventually.

10/26/93 Mark B Pyke

(51)

10/26/93 Mark B Pyke

(52)

On the basis of the site visit on the interviews conducted and the materials received, it was evident that we had material needed for completion of PA. We, therefore, discussed and agreed to complete activities at the MARC that afternoon.

I debriefed Ms. Groll and Ms. Reilly on what we had found, our view of their standing within the IRP, and on what subsequent actions to expect/do relative to the IRP.

Visit was completed at 3:20 PM. We took our materials, miscellaneous reports received and departed

P.S.: Ms. Groll noted rumors that Silver Creek Park had been old dumping site for dead gangsters during Prohibition. (May be continued thereafter.)

10/26/93 Mark B. Pope

(53)

10/26/93 Mark B. Pope

(54)

PHOTO LOG (panoramas)

(15 photos)

PAN 1) West MARC from main building
PAN 2) NW " " " "
PAN 3) SW " " " "
PAN 4) From NE corner of building looking south to Level Field
PAN 5) From north of Level Field looking Toward pump house & Vehicle storage
PAN 6) Drill hall and Vehicle storage area
PAN 7) SE corner of Vehicle area looking east Toward lake Michigan - MW in background
PAN 8) From SE corner of Vehicle area looking North
PAN 9) Facing east from NE corner of MARC
PAN 10) Northern section of Vehicle Storage Area including Vehicle Maintenance Shop
PAN 11) North centered view into MARC including Drill Hall and Training Center
PAN 12) Privately owned Vehicle parking lot
PAN 13) U.S.A.R. Training Center entrance
PAN 14) Vehicle Storage Area from northern section of area.
PAN 15) Wrecker and Vehicle Maintenance Shop

10/29/93 Mark B Pope

(53)

10/29/93 Mark B Pope

(56)

PHOTO LOG (Normal shots 3½x5")
(24 photos)

P-1) Monitoring Well 2B, west side of MMKL
P-2) " " 2A, " " "
P-3) Pumphouse to Leech Field
P-4) Manhole access to Leach Field
P-5) POL shed and MWS Thru east fence
P-6) Washrack (Site 1) with vehicle over it.
P-7) Excavated Dry Well (Site 1)
P-8) Parts Cleaning Unit w. Vent Head inside maint. shop
P-9) Lubricating Oil storage inside maint. shop
P-10) Waste Oil/Waste Antifreeze storage tanks
P-11) Abandoned Vehicle maintenance rack (outside)
P-12) POL shed and new HM Storage shed
P-13 and 14) Materials stored inside POL shed
P-15 ~~and 16~~) Empty cans and barrels inside POL shed
P-17) Materials stored inside POL shed
P-18) Left side of HM storage shed
P-19) Right " " " " "
P-20) Monitoring Well 5 east of POL shed
P-21) Maintenance shop South looking North
P-22) SE corner of Vehicle Storage area
P-23) Storage Tent (may be winterized)
P-24) Left Bay of Maintenance Shop showing Grease Pit outside

End of NOTES From Field Trip

10/29/93 Mark B. Peyke

(57)

END OF NOTES FROM FIELD TRIP TO MANITOWOC ARMY RESERVE CENTER

10/29/93 Mark B. Peyke

APPENDIX B: PHOTODOCUMENTATION LOG

APPENDIX B: PHOTODOCUMENTATION LOG

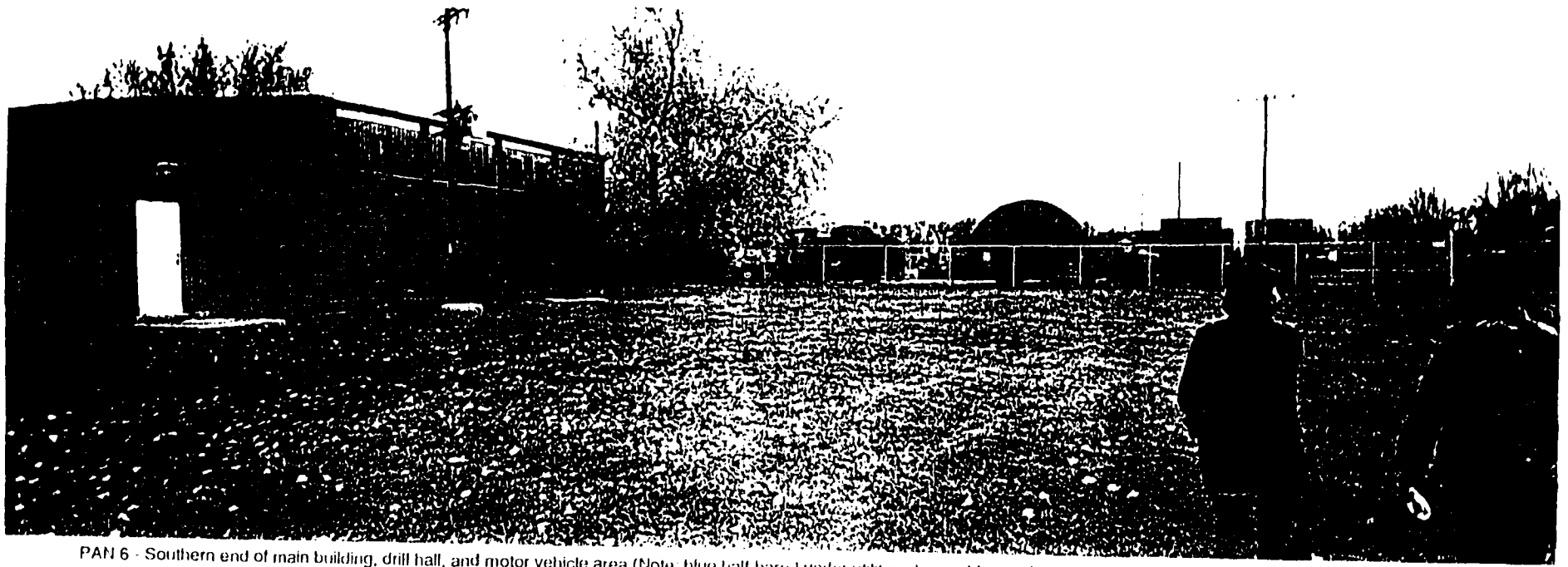
PAN 1 - Facing northwest of facility away from main building (northwest corner of private vehicle parking lot on right side of photo)

PAN 2 - Facing west of facility away from main building (mow line indicates end of MARC property)

PAN 3 Facing southwest of facility away from main building (Note: two wells west of leach field; from left to right MW 2B, MW 2A)

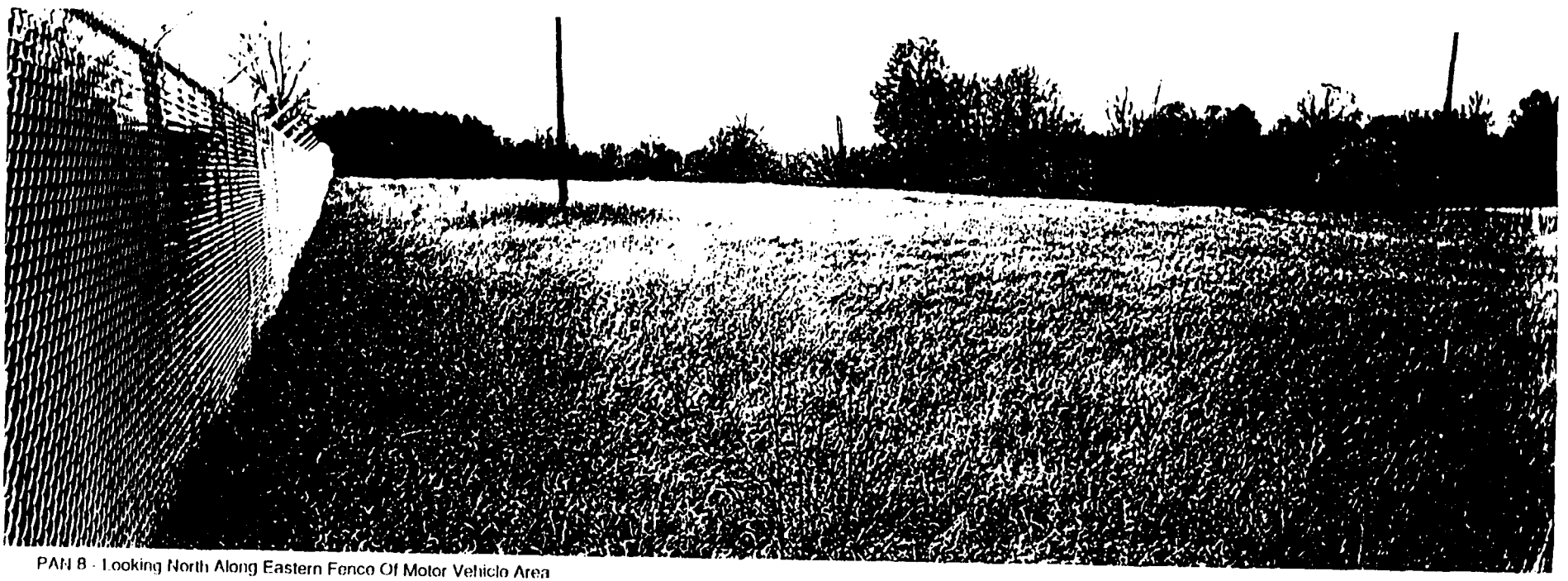
PAN 4 Leach field (Site 4) with vent pipes (facing south away from main building)

PAN 5 - Eastern end of leach field, Pump House, southern end of vehicle storage area



PAN 6 - Southern end of main building, drill hall, and motor vehicle area (Note: blue half barrel under utility pole used for storing drinks in summer)

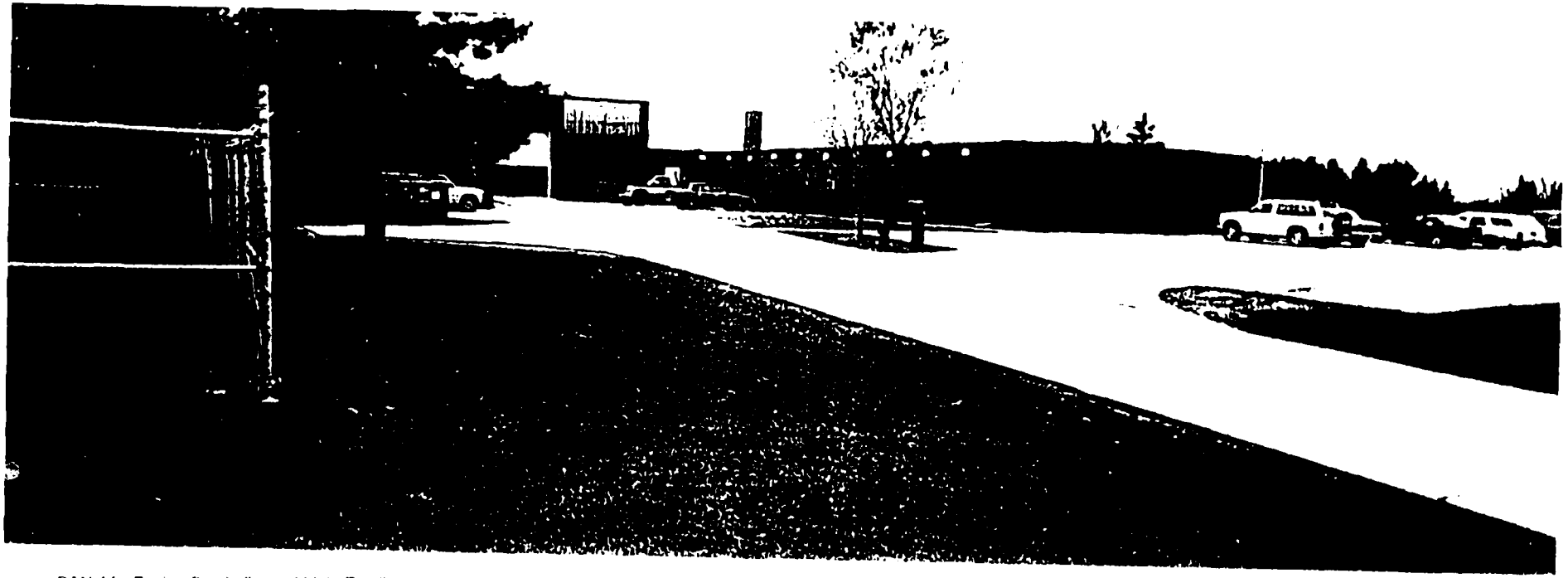
PAN 7 - Southeast Corner Of Motor Vehicle Yard Facing East Toward Collector "B" (Not Shown)



PAN 8 - Looking North Along Eastern Fence Of Motor Vehicle Area

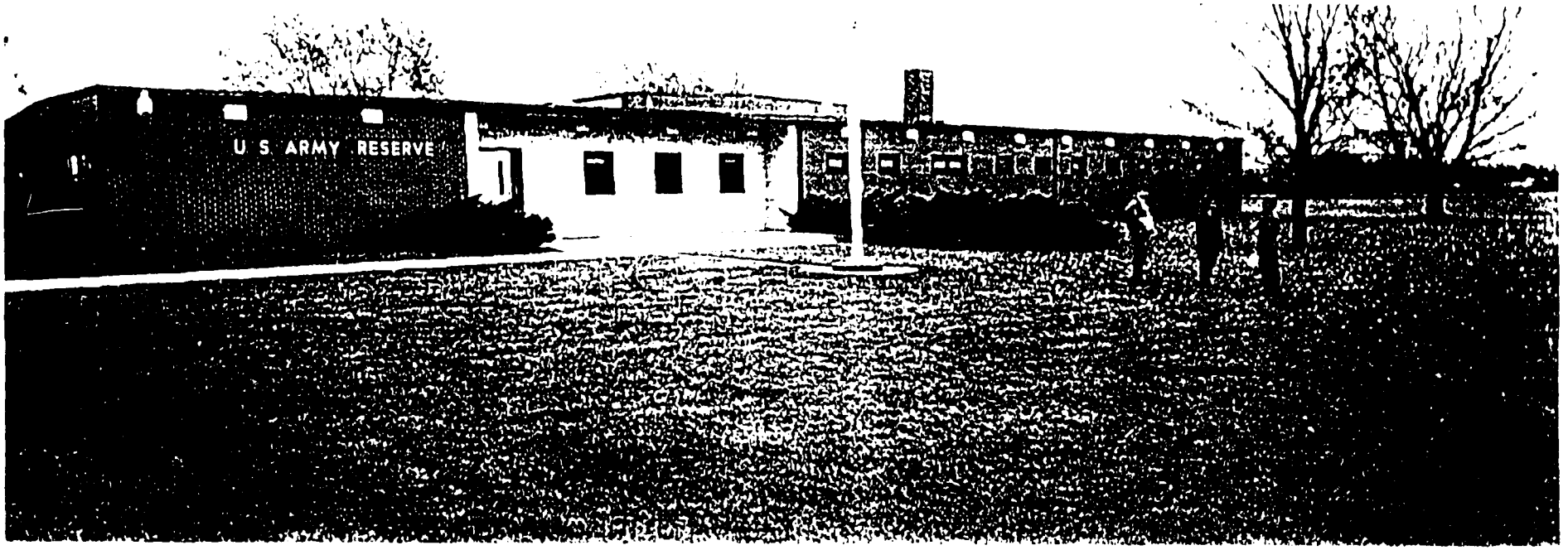
PAN 9 - Facing East Toward Lake Michigan (Note: All Property In Photo Is Silver Creek Park)

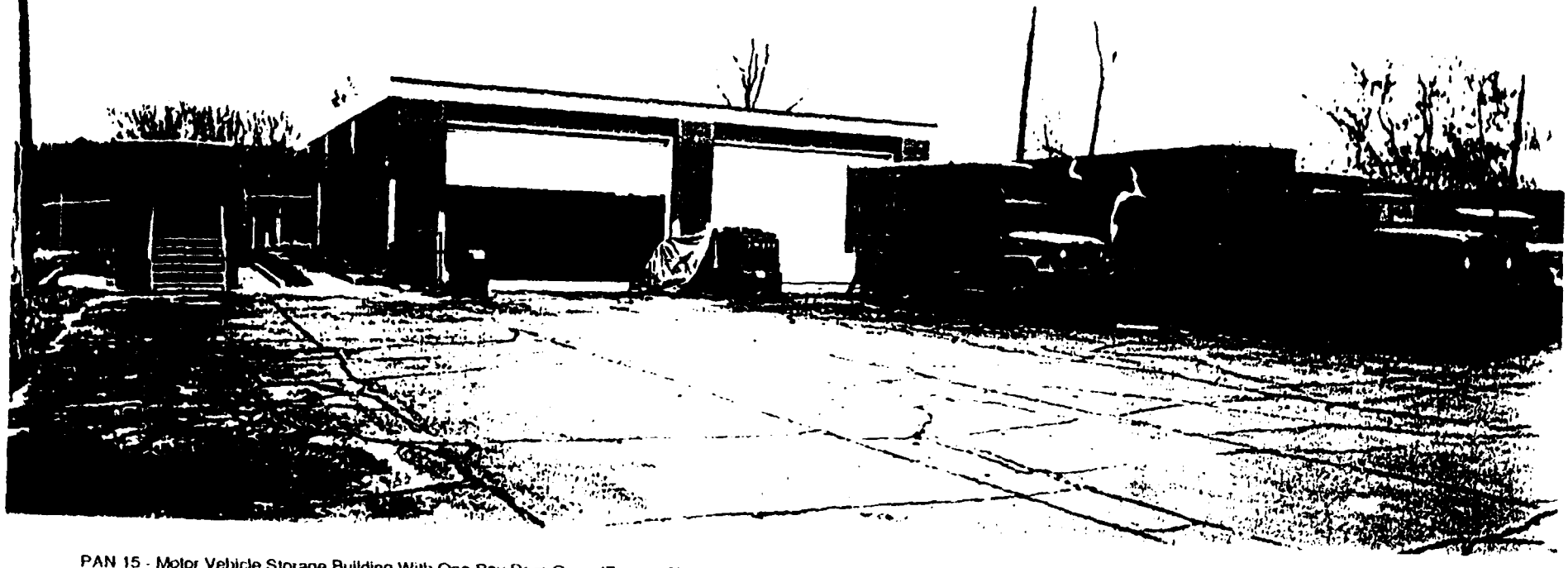
PAN 10 - Facing Southwest Toward MARC (Note: Electrical Generators Located Just Inside Fence; Main Building Seen On Right Side Under Flag)



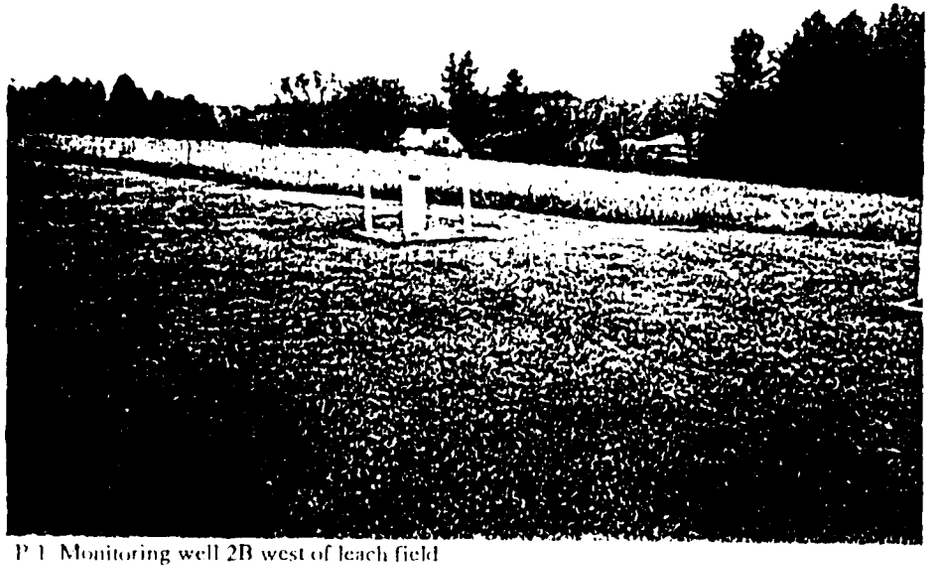
PAN 11 - Facing South Toward Main Building And Drill Hall (Electric Generator On Left Just Inside Fence On Grass)

PAN 12 - North End Of Main Building, Bituminous Private Parking Lot, Entrance To MARC From Silver Creek Park Access Road

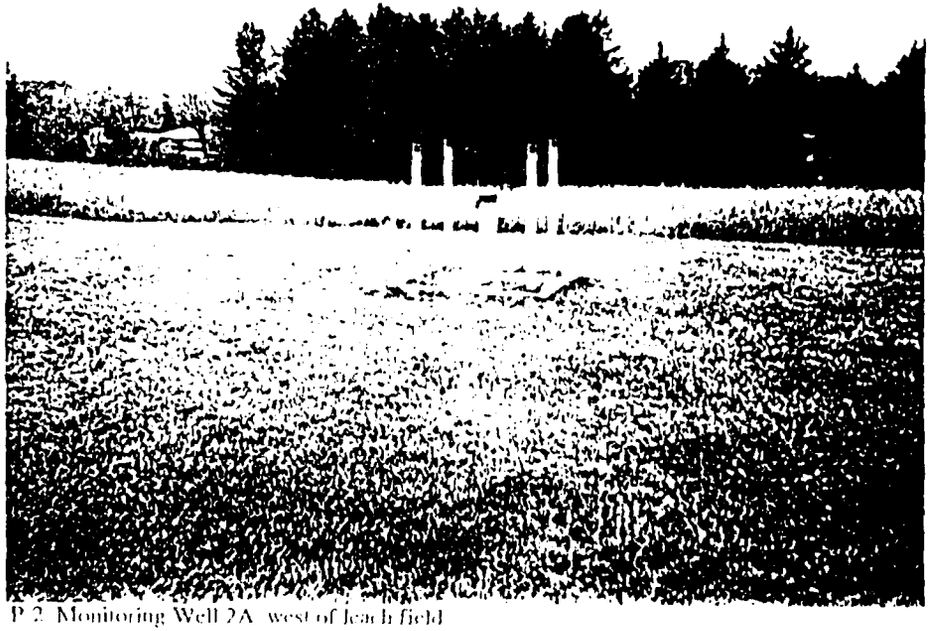

U S ARMY RESERVE



PAN 15 - Motor Vehicle Storage Building With One Bay Door Open (Former Site of Grease Pit); Paint Storage Room Entrance Is Rear Door On Left Side Of Building; Washrack/Dry Well Is Immediately Left Of Building With Army Vehicle Parked Over Top; Battery Storage Area Is Just Inside Building In The Middle

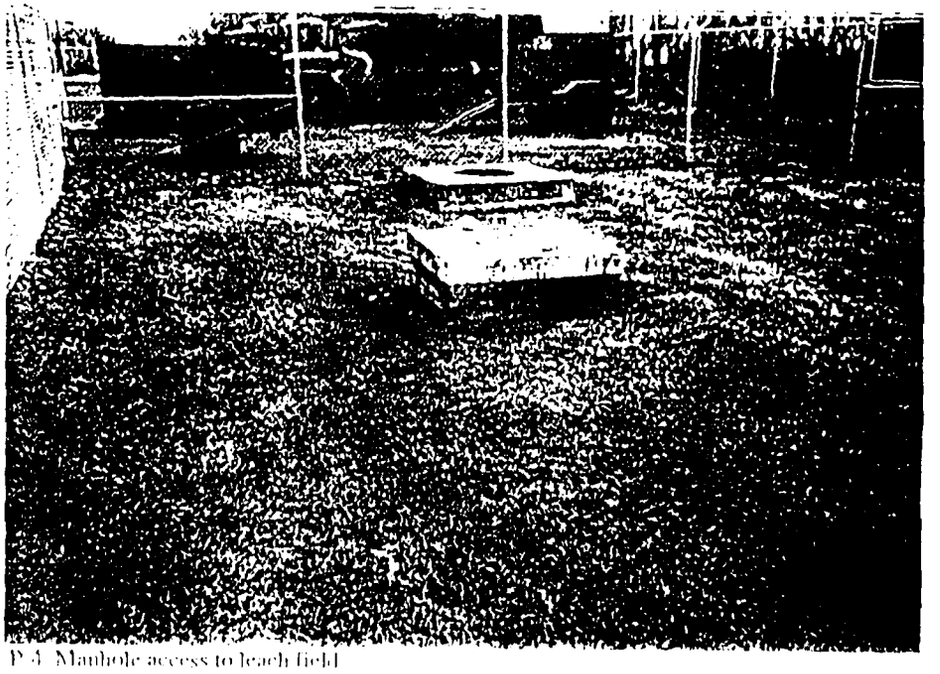


P-1 Monitoring well 2B west of leach field



P-2 Monitoring Well 2A west of leach field

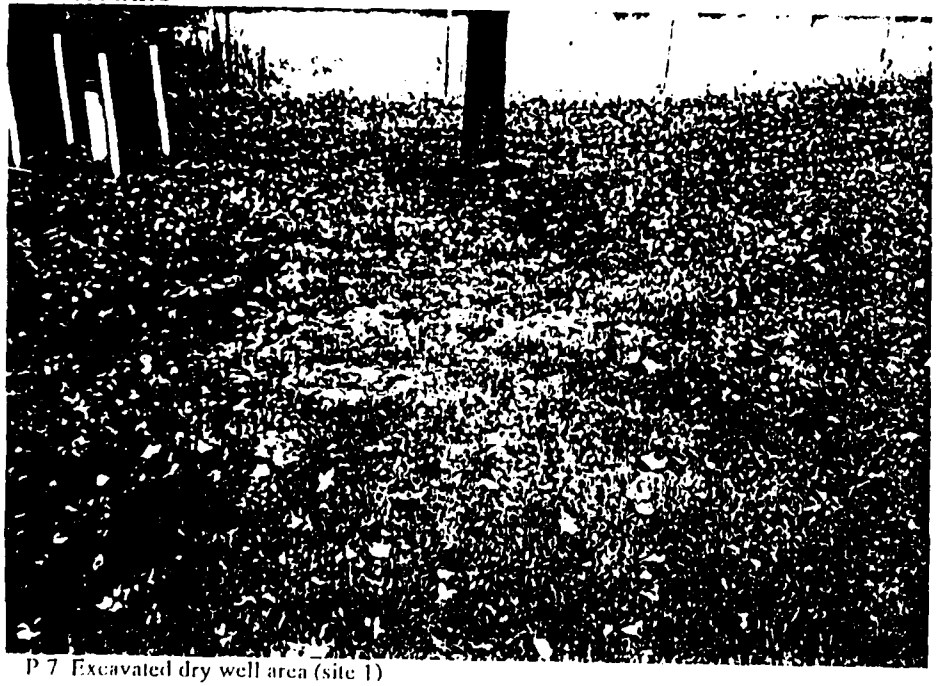
P-3 Leach field pumphouse



P-4 Manhole access to leach field

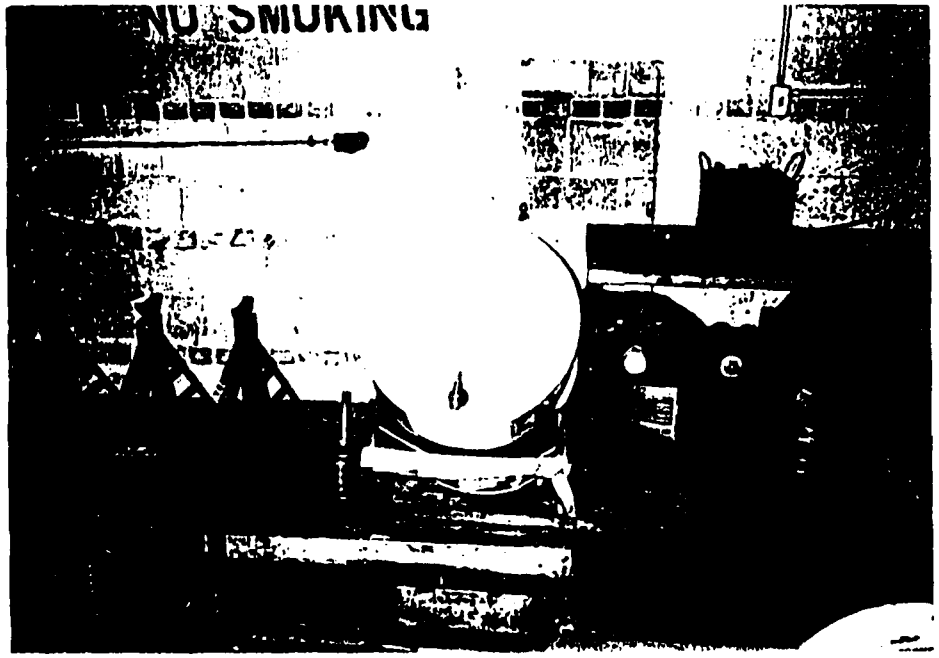
P 5 POL shed (site 7) and monitoring well 5 viewed from east of MARC

P 6 Wash rack (site 1) with vehicle parked over it

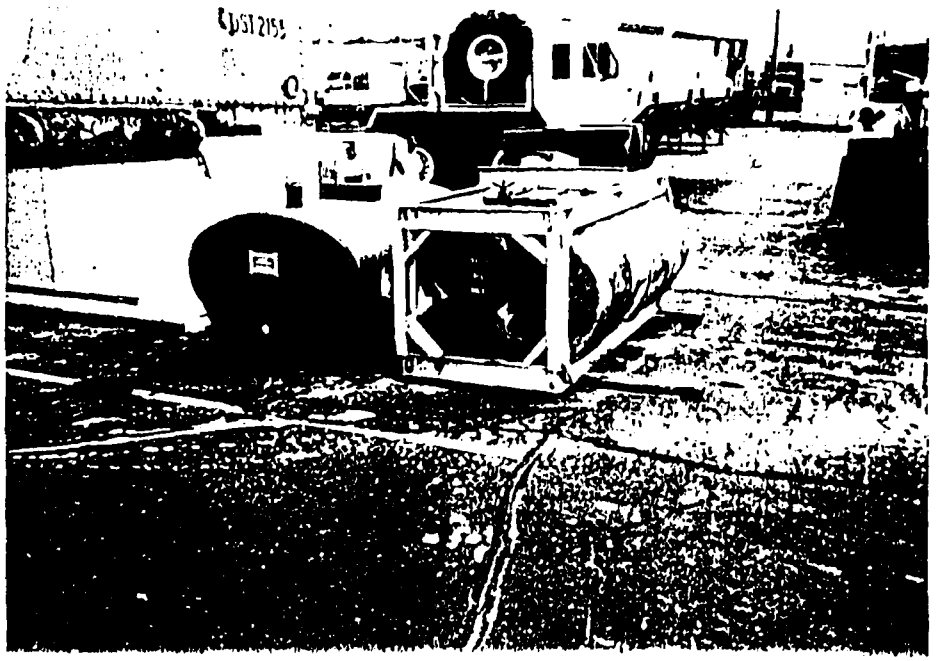


P 7 Excavated dry well area (site 1)

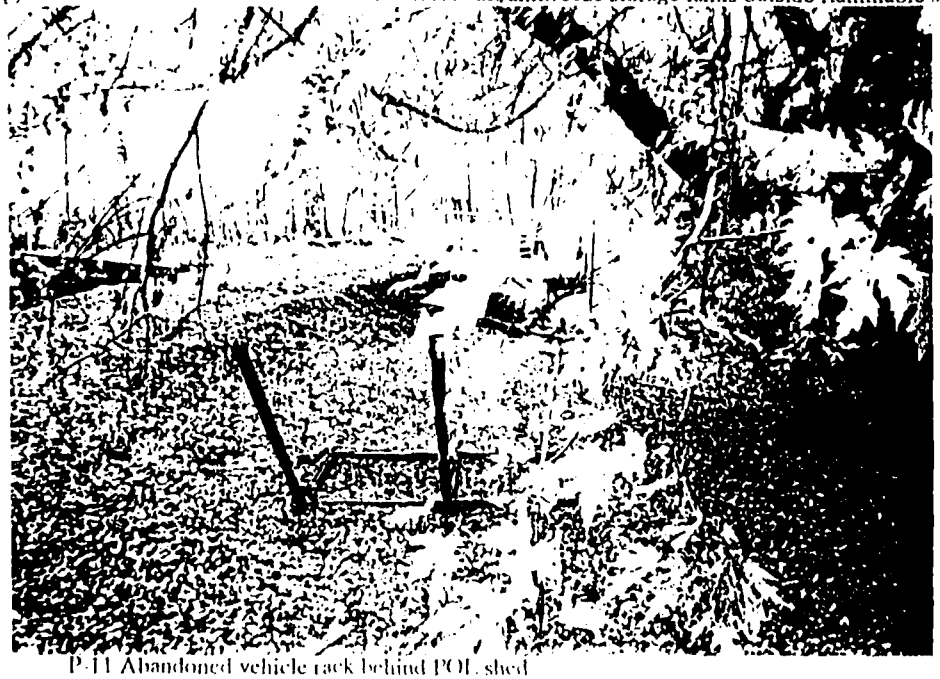
P 8 Parts cleaner (site 5) serviced by Safety Kleen



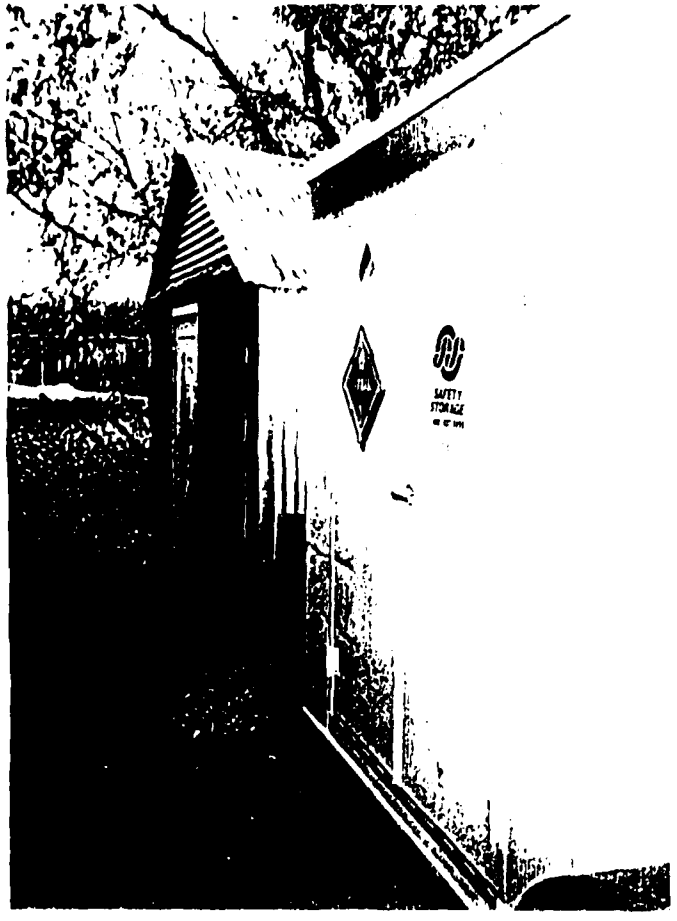
P-9 Lube oil stored in motor vehicle storage (maintenance shop)



P-10 Waste oil/antifreeze storage tanks outside flammable storage shed



P-11 Abandoned vehicle rack behind POL shed

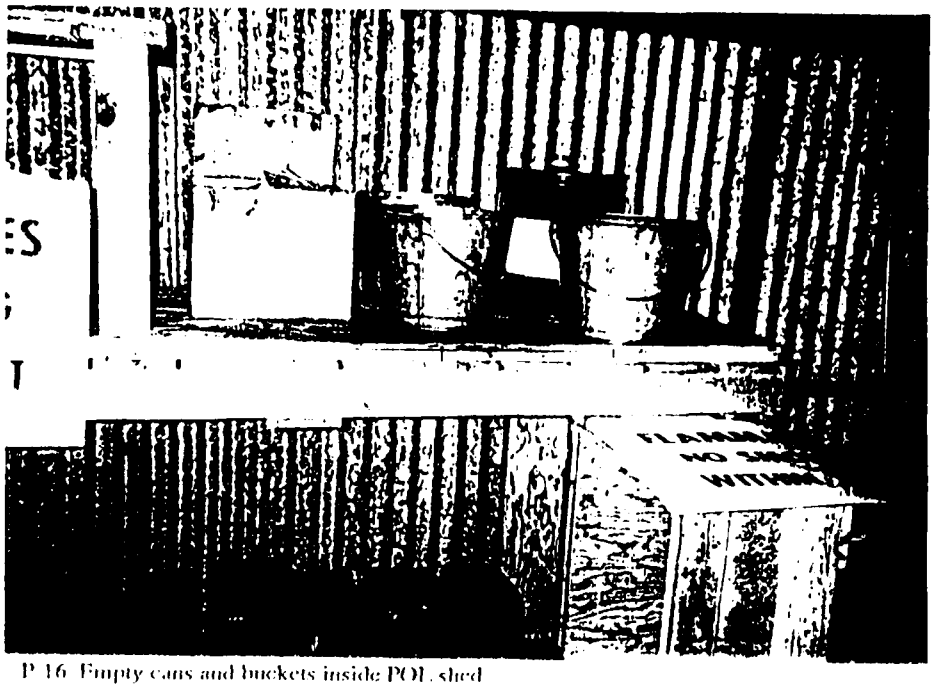


P-12 POL (site 7) and flammable storage sheds

P-13 Material stored inside POL shed

P-14 Material stored inside POL shed

P-15 Empty cans and barrel inside POL shed

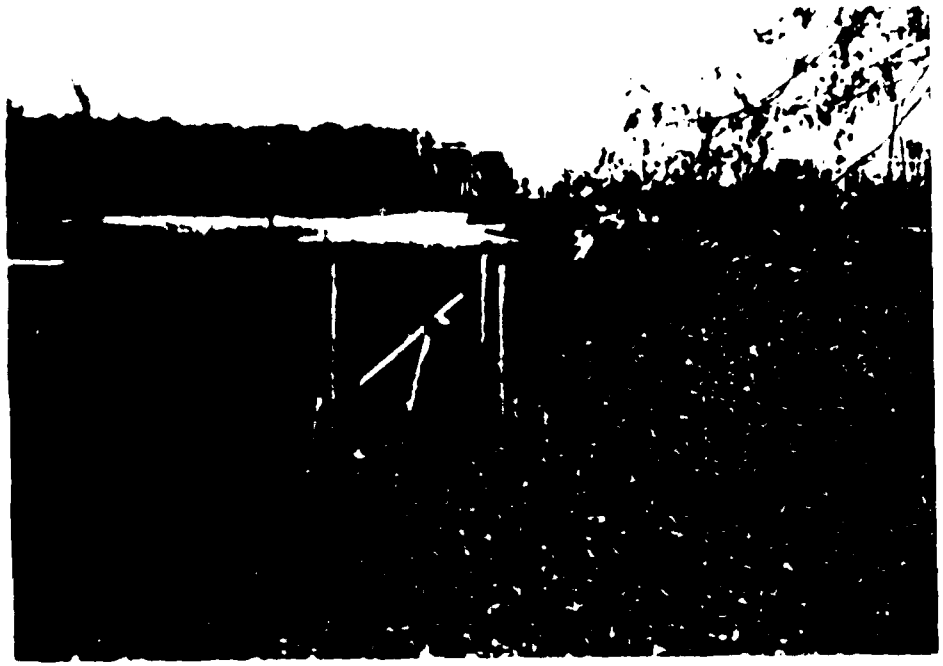


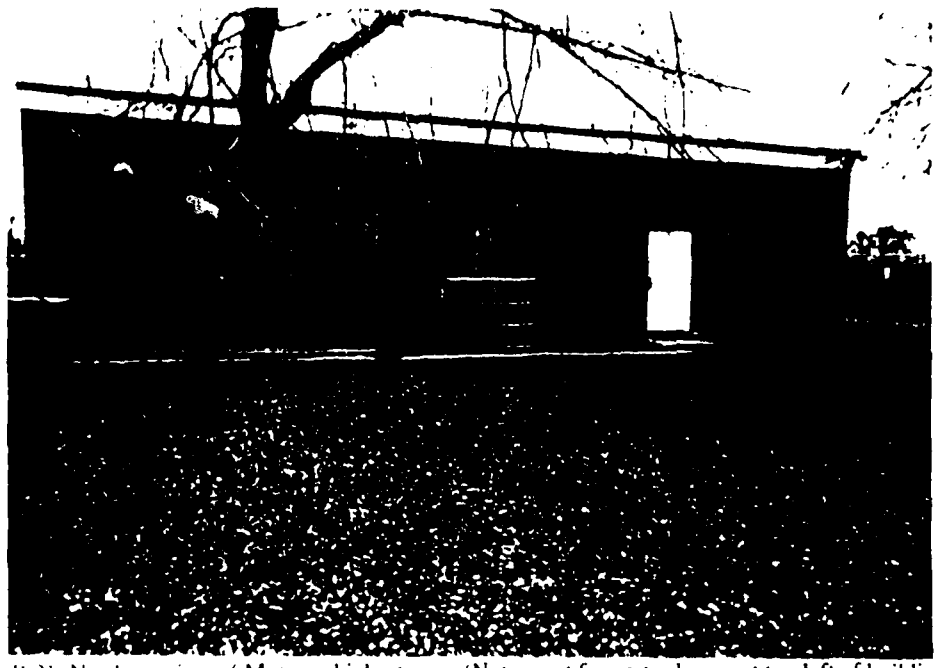
P-16 Empty cans and buckets inside POL shed

P-17 View of stored materials in POL shed

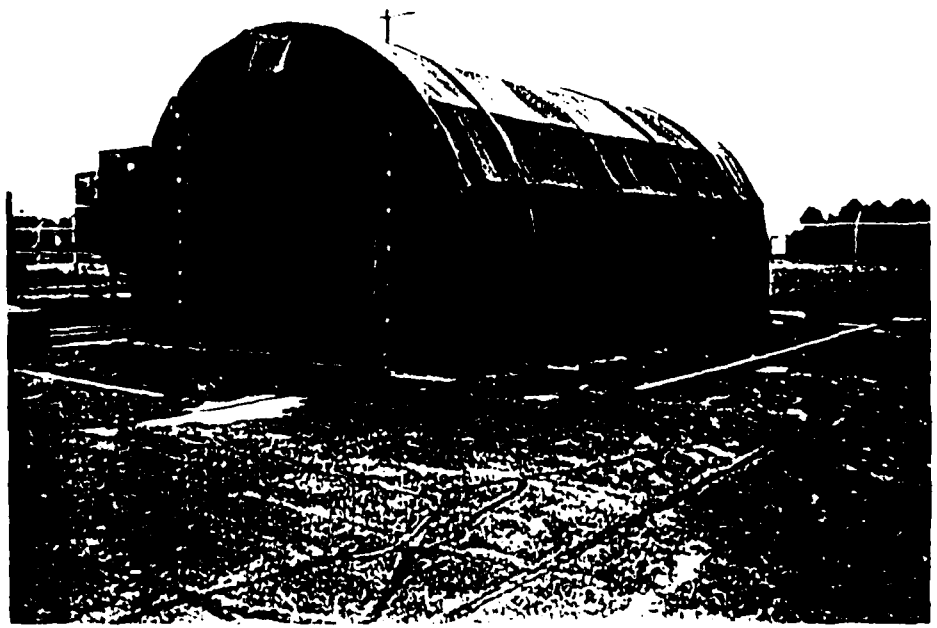
P-18 Left side inside flammable storage shed

P-19 Right side inside flammable storage shed

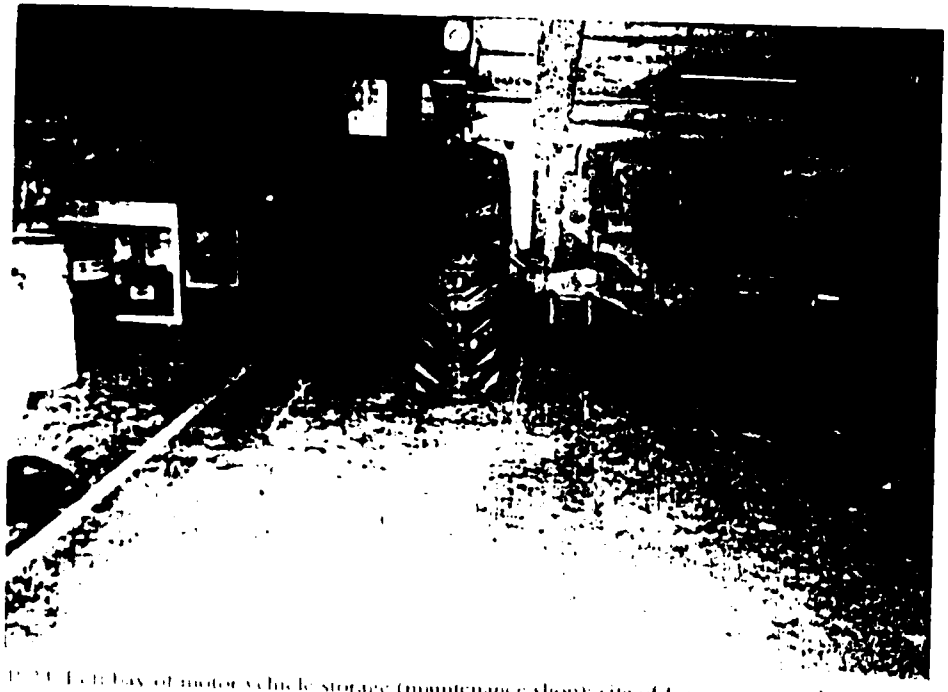




P-21 Northern view of Motor vehicle storage (Note: vent for parts cleaner at top left of building)



P-23 Storage unit for dry goods and parts



[illegible] East bay of motor vehicle storage (maintenance shop); site of former grease pit [illegible] that has been filled and capped

APPENDIX C: KEY COMMUNICATIONS

APPENDIX C: KEY COMMUNICATIONS

APPENDIX C: KEY COMMUNICATIONS

CORRESPONDENCE/MEMORANDUM — STATE OF WISCONSIN

Date: October 12, 1987 File Ref: 3300

To: David Hildreth

From: Jeff Haack JH

Subject: Groundwater Contamination Case - Manitowoc "B" (Case #86029)

This memo is to summarize the background information and current status of the above-referenced groundwater contamination investigation. Ranney Collector "B", operated by Manitowoc Public Utilities, has been confirmed to be contaminated with Trichloroethylene (TCE).

A brief description of the Manitowoc public water supply system is in order first. The City utilizes a surface water treatment plant, with Lake Michigan as the raw water source, as the primary water supply. Construction of the treatment plant was completed in the early 1970's. Prior to that, the City obtained all of it's water supply from three Ranney type wells. A Ranney well consists of a large diameter caisson set to the required depth in the aquifer with screens driven radically from the the caisson into the aquifer. The City regularly uses Collector "C" to avoid stale water problems in what would otherwise be a very long dead-end main. Collectors "A" and "B" are maintained for standby. Attached are the following: A USGS map showing the locations of the described facilities; a schematic of a Ranney collector well; a plan view of Collector "B" showing the layout of the radial collectors; and a profile view of Collector "B" which includes water level measurements during the test pumping period.

Collector "B" was initially sampled for VOC's on December 10, 1985, as part of the department's routine sampling of all municipal wells. 9.2 micrograms per liter (ug/l) of TCE were reported. No other VOC's were detected. A check sample collected on January 14, 1986, confirmed the presence of TCE with a concentration of 6.6 ug/l. Early investigation of this matter revealed two potential sources of contamination. First, the motors and pump-heads had recently been cleaned using a degreaser. Contamination of the water via cracks and joints, and contamination of the samples via odors were considered possibilities. Secondly, it was discovered that a petroleum-based oil was being used in one of the pumps at this station (as well as one of the pumps at Collector "A") which was an oil-lubricated pump. The water system operator was advised to replace the oil with a food-grade oil immediately. The City complied with this advice. It was also recommended that they steam clean the entire well, both the above-grade pumphouse and the below grade well.

The "Registry of Abandoned Landfills in Wisconsin" was reviewed and the presence of a landfill for disposal of ash from Manitowoc Public Utilities power plant is noted in the SW¼ of the NE¼ of Section 6. Also, a landfill owned by Radant and Sons, Inc. is identified in the NW¼

of the SE¼ of Section 6. This landfill is believed to contain municipal refuse as well as construction materials. Two wells owned by private individuals along CTH LS, close to the Radant Landfill, were sampled February 3, 1986, and found to be free of any VOC's. Well data for these wells is unknown.

The City completed steam cleaning Collector "B" in September, 1986. Another sample was collected on October 27, 1986, and 6.5 ug/l of TCE was reported. It was then decided that the scope of our investigation should be expanded and a case number, as well as lead and support staff were identified in your December 12, 1986 memo.

On April 23, 1987, Don Johnston conducted an inspection at the U.S. Army Reserve Center, located several hundred yards west of Collector "B". A copy of his report (form 4400-106) was routed through channels. A small parts-washer was observed, though the composition of the solvent used was unknown. Reportedly, chemical wastes are shipped to Fort McCoy. The facility also has a wash rack for washing motor vehicles. The drain for this area discharges to a dry well. Don didn't note any strong fumes, but he did report an oily sheen on the water in the sump. A follow-up visit to sample this sump may be appropriate.

On September 29, 1987, Rick Stoll and I spent several hours in the area to investigate further. Another sample from Collector "B" was collected. Also, 2 private wells (Dale Fischer and Bill Stievater), located close to Collector "B" were sampled. Those results are not yet available. We inspected the recharge well to the south of Collector "B" and several of the test wells. The recharge well was formerly used to pump water from Lake Michigan into the aquifer. Although it seems unlikely that the test wells or the recharge well are the source of TCE contamination, they present a definite potential for bacteriological contamination of the aquifer. The City was advised that these must be properly abandoned. This will be confirmed in writing.

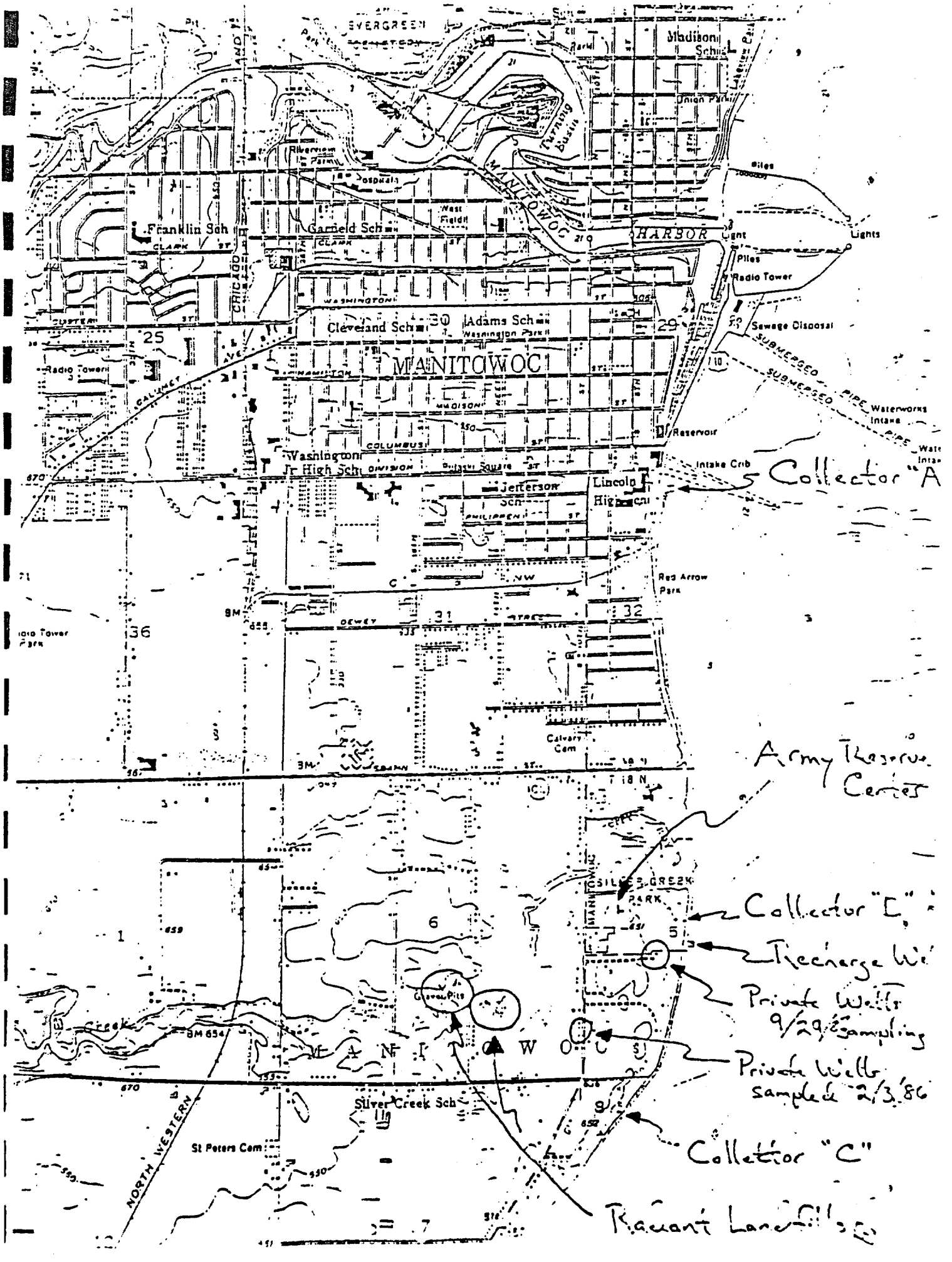
The U.S. Army Reserve Center is the only apparent potential source of TCE contamination near Collector "B". Contamination of the well during the cleaning and reactivation of this station remains a possibility though. When the analytical results form the September 29, 1987, sampling are received, we'll have to decide what to do next.

The U.S. EPA has proposed an MCL of 0.005 mg/l (5 ug/l) for TCE. The City has been advised that Ranney Collector "B" shall not be used to supply water to the distribution system. The only exception to this would be in case of an extreme emergency, such a a catastrophic fire. Since the well is not used to supply drinking water, no public notification has been ordered.

If you have any questions or suggestions please contact me.

JJH:km
Attachments (4)

cc: Bob Barnum (Attn.: Rick Stoll)
Don Johnson (w/o attachments)
Public Water Supply Section


EVERGREEN
Madison Schl
Union Park
Riverview Park
Hospitals
Franklin Sch
Garfield Schl
West Fields
HARBOR
Light
Lights
Piles
Radio Tower
Cleveland Schl
Adams Schl
Washington Park
MANITOWOC
Sewage Disposal
SUBMERGED PIPE
Waterworks Intake
Reservoir
Intake Crib
Washington Jr High Sch
Jefferson Sch
Lincoln High Sch
Red Arrow Park
Radio Tower Park
Calvary Cem
Army Reserve Center
Collector "A"
Collector "B"
Recharge Wells
Private Wells 9/29/85 sampling
Private Wells sampled 2/3/86
Collector "C"
Vacant Landfill
Silver Creek Park
Silver Creek
Silver Creek Sch
St Peters Cem
NORTH WESTERN
MANITOWOC
Gravel Pits
BM 654
CLARK ST
WASHINGTON ST
MADISON ST
COLUMBUS ST
DIVISION
PHILIPPENI ST
DEWEY ST
CALUMET AVE
CHICAGO AVE
MANITOWOC RIVER
T 18 N
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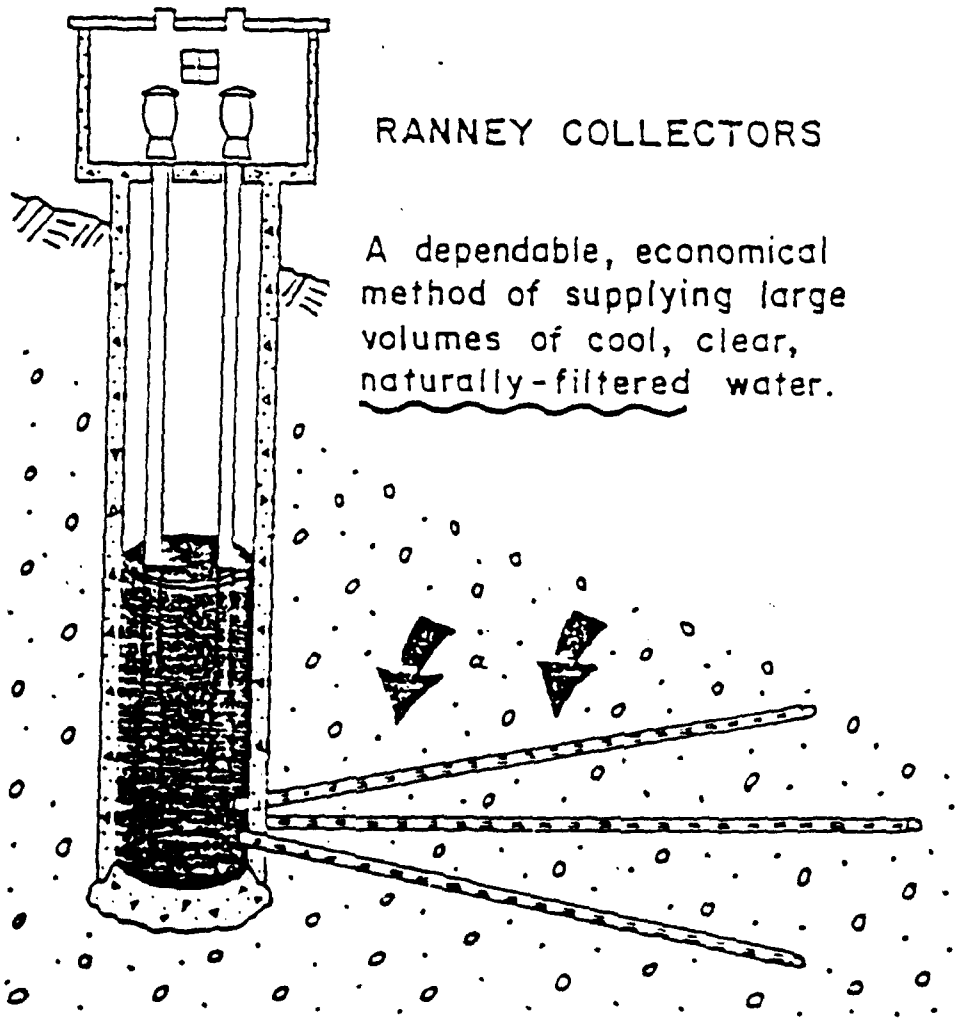
RANNEY METHOD



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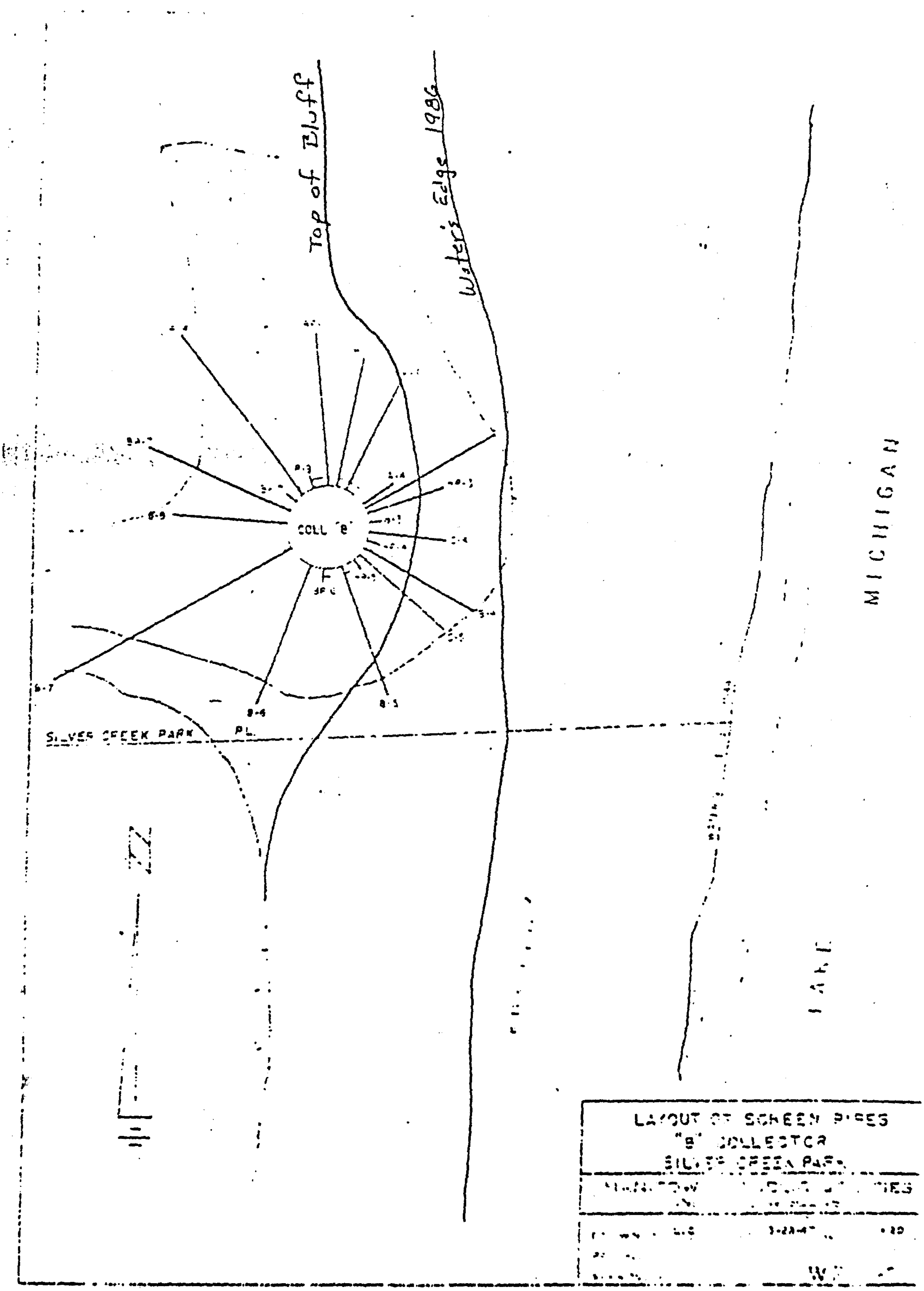
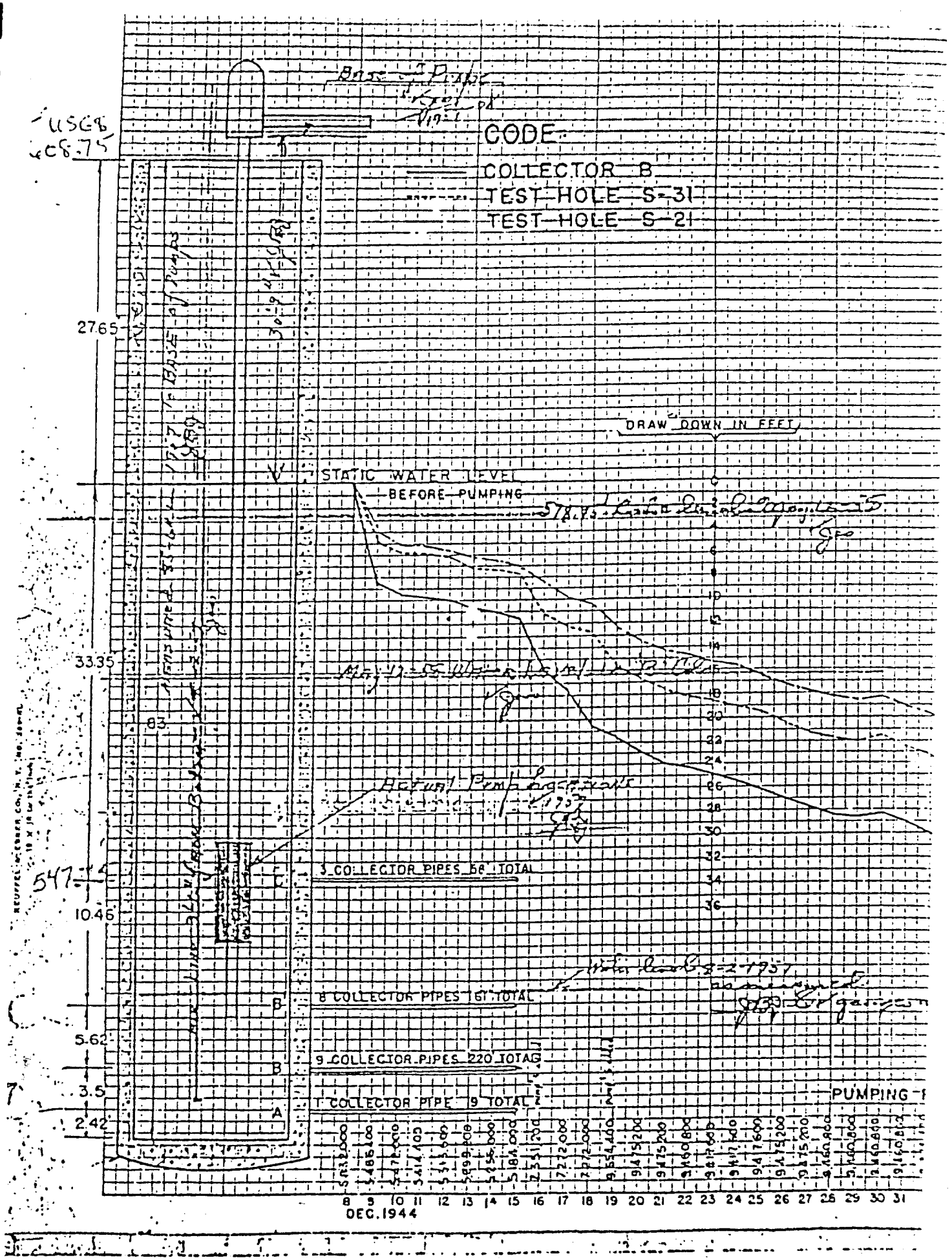
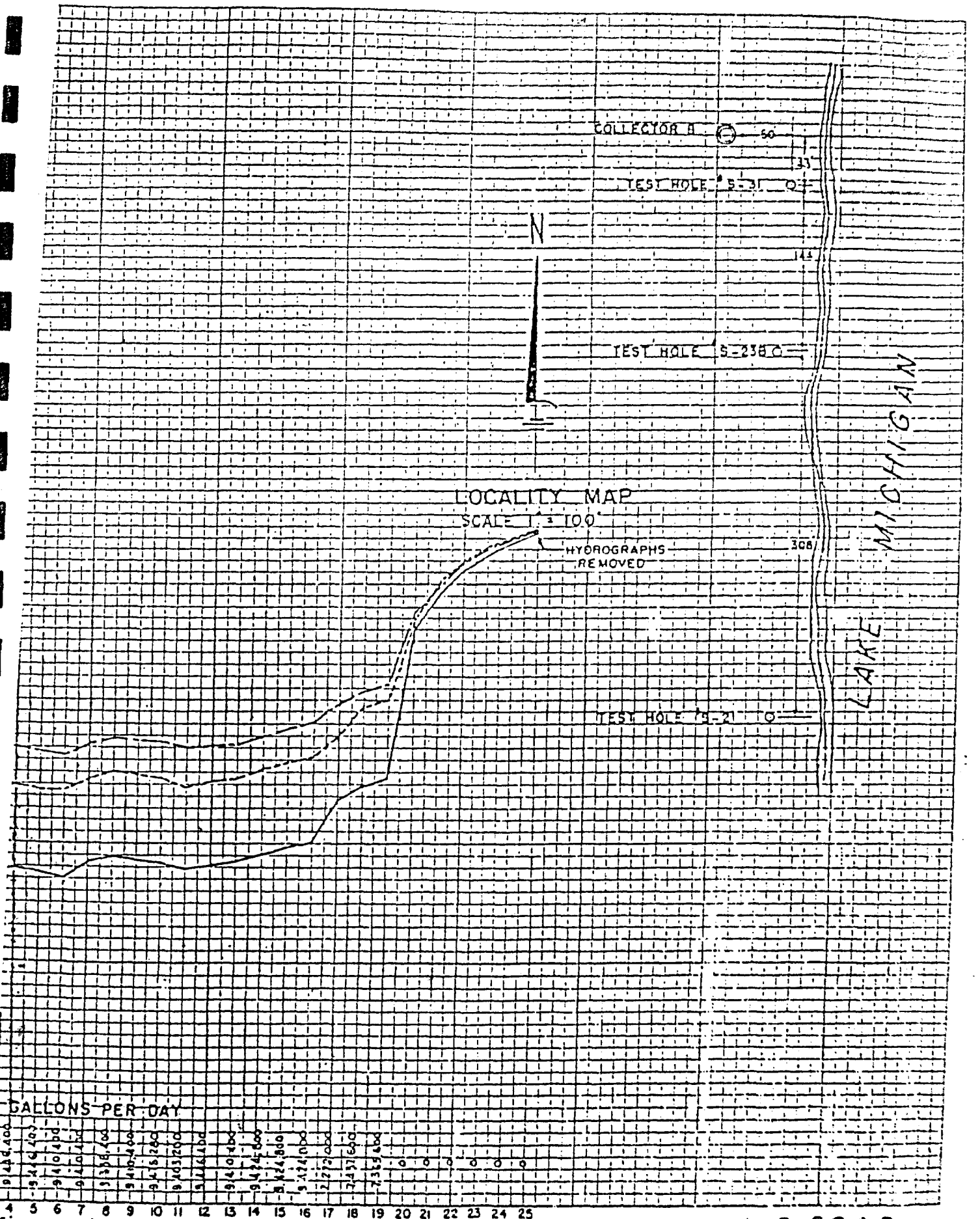

Top of Bluff
Water's Edge 1986
COLL "B"
SILVER CREEK PARK PL.
MICHIGAN
LAKE
LAYOUT OF SCREEN PIPES
"B" COLLECTOR
SILVER CREEK PARK


USGS
CODE
COLLECTOR B
TEST HOLE S-31
TEST HOLE S-21
DRAW DOWN IN FEET
STATIC WATER LEVEL
BEFORE PUMPING
3 COLLECTOR PIPES 56' TOTAL
8 COLLECTOR PIPES 61' TOTAL
9 COLLECTOR PIPES 220 TOTAL
1 COLLECTOR PIPE 9 TOTAL
PUMPING
27.65
33.35
.83
5.47
10.46
5.62
3.5
2.42
DEC. 1944


COLLECTOR A
50
33
TEST HOLE S-31 O
N
141
TEST HOLE S-23B O
LAKE MICHIGAN
LOCALITY MAP
SCALE 1" = 100'
HYDROGRAPHS REMOVED
308
TEST HOLE S-21 O
GALLONS PER DAY
4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25
45

WP-504-S

Manitowoc Ramsey Collector B
Sampling Synopsis - TCE - µg/l

Date	Result	Comments
2-10-85	9.2	initial VOC screen
1-14-86	6.6	✓
10-27-86	6.5	after steam-cleaning
9-29-87	5.7	Fischer & Stierwalter wells were c
1-19-88	9.4	3 radial arms open - only (
3-14-88	5.4	only radial arms to lake open

State of Wisconsin \ DEPARTMENT OF NATURAL RESOURCES

Green Bay Area Headquarters
200 N. Jefferson
Suite 511
Green Bay, WI 54301

Carroll D Besadny
Secretary

May 4, 1988

File Ref. 3400

Mr. Robert Steffen
US Army Reserve Center
3125 S. 10th Street
Manitowoc, WI 54220

Dear Mr. Steffen:

RE: Notification of Non-compliance

This letter is to confirm our conversation of Tuesday, April 19, 1988. Sgt. Terry Stout and Don Johnston, Hazardous Waste Specialist, also participated in that discussion.

The Wisconsin Department of Natural Resources is concerned abut the apparent non-compliance with Chapter 147.02 of state statutes. This section reads, in part, that "The discharge of any pollutant into any waters of the state... shall be unlawful unless such discharge or disposal is done under a permit issued by the department". Specifically, we are concerned about the discharge from the motor vehicle "washing rack" to a french drain, ultimately having a potential impact on the local groundwater. Additionally, we have concerns about compliance with the department's hazardous waste regulations.

In order to address the concerns about potential groundwater impacts, we are requesting the installation of several groundwater monitoring wells in the vicinity. If contamination is detected in those wells, further investigation will be required.

We also discussed the composition of the solvents used at the Reserve Center. To date, we have been unable to acquire information on these materials.

Please respond to this notification within 30 days. Your response should include a proposed schedule for installing monitoring wells, as well as any information concerning the solvents used at the facility.

Please also include a description of the current practice used at the wash rack (i.e. number of vehicles washed per year and the quantity and type of cleaners or solvents used). This information will be used to evaluate whether it is appropriate to issue a permit for the discharge.

If you have any questions, please contact me at (414) 497-4337.

Sincerely,

Jeffrey J. Haack
Area Engineer

JJH:km

cc: Doug Rossberg

AFZR-DEH-E 26 May, 1988

MEMORANDUM FOR RECORD

SUBJECT: Manitowoc Trip Report

Upon arrival to the Reserve Center Tuesday morning, Joan and I briefed Bob Steffan, Facility Coordinator, 84th ARCOM about the substance detected and the other pieces of information gathered from my discussion with Jeff Haack. Nannette Groll, Unit Administrator, 86th ARCOM, 377th Maintenance Company, and Sgt. Wanner, fulltime Maintenance Supervisor joined us and we asked a series of questions relating to the handling and storage of substances on the reserve center. We learned that currently waste oil and used solvents are turned in to the City of Manitowoc for recycling. Joan informed them they could no longer pursue this practice and that these items should go to the DePere AMSA.

In addition, we discussed the wash rack. As noted by the DNR they wanted information as to the use of this wash rack. Sgt. Wanner stated that approximately 20 vehicles are steam cleaned annually. An additional 50 vehicles are washed annually using hot water only.

We then proceeded to investigate the Center including the POL shed. The DNR was concerned because in their visit they cited the shed as having a dirt floor. We investigated and determined the shed does have an asphalt floor, but is in some disarray. Joan discussed this with Bob Steffan. He initiated the inventorying process and stated the POL shed will be cleaned and straightened up sometime this summer. Joan took stock numbers on various cans to determine their contents. In addition we took a soil sample of an area which had dead grass. Some of the areas which had dead grass were locations for pallets. This general area is also where the generators are fueled. Joan and I speculate that the staff may be dripping gas onto the grass when they fill the tanks. Also the grassy area is a shortcut from the POL shed to the maintenance shop.

In investigating for possible sources of TCE it appears that the shop area of the center is in good order and Sgt. Wanner could not cite any spills within the last three years. Bob Steffan and Nan could not cite any either, but stated they did not have initmate knowledge of that area. There are no records of purchases from the Reserve Center prior to 1986. Records are only kept for two years. Sgt. Wanner appeared to have good knowlege of the current use and disposal of solvents in the shop.

We did learn the Reserve Center shop had a grease pit that has been filled and capped with cement. We discussed this area being the source of groundwater contamination, though the design plans do not show a floor drain in the bottom of this pit. The shop also has a parts washer. The shop generates 5 gallons of solvent annually.

We also investigated the dry well for the wash rack to see if there was a drain from the grease pit. The well is approximately

6'x 6' and is constructed of cinder block walls. The floor is sand and was coated with oil. The well had a strong stench which smelled of something besides oil (possibly). We took two soil samples. We also took soil samples of the wash rack pit.

Joan and I left the Reserve Center at about 1:00pm and traveled to Green Bay to meet with Jeff Haack from the DNR. At the beginning of our meeting I described the areas we investigated at the Reserve Center and provided information about the use of the wash rack and the floor in the POL shed. Jeff did not have a problem with our results. In a much longer discussion about the TCE problem, we looked at the map of the area. Jeff described what the history of the contamination problem had been dating back to the first sampling in 1985. We discussed possible sources from abandoned landfills. Although there is one known landfill in the area it had only been used for municipal waste+construction materials. Nan had made a few phone calls when Joan and I were at the Reserve Center and determined that prior to the Center being located on the property, the land had been farmed. This discounted any hope that the TCE came from a abandoned dump. We then discussed the cone of depression from Collector B (the well showing contamination). I had thought the cone might be severe enough as to draw water from the industrial park which is about a mile away. Jeff had a map of the cone from the collector and determined that wasn't possible. Prior to sampling the city would pump intermittently for up to 2 days to purge the well. The cone is not developed enough to draw water very far away. We discussed Silver Creek being the conduit for groundwater pollution on our side of the creek. There is nothing in the area to pollute the creek and the homes sampled near the creek all have clean wells. Unfortunately there are no well construction reports. Jeff estimated these private wells are 80 to 90 feet deep. Most of the other residences in the area are hooked up to city water.

Apparently Jeff and the other staff feel the TCE was introduced into the groundwater some time back-maybe as far as 10 years ago. He did not have a good handle on the flow rates for groundwater in the local area. His best guestimate of general flow is East though he does wonder about the flow of local groundwater around the Reserve Center since it sits on top of the hill. Jeff did not have any information for us about the compound other than it is a solvent.

We discussed in vague terms what the DNR will do if there is not a responsible party identified (the Reserve Center). Jeff stated the Department may pursue the installation of the monitoring wells with Wisconsin Environmental Repair Funds (ERF). If the results from the monitoring wells indicate the Reserve Center is the responsible party, the DNR will charge all expenses to us. A second option is the DNR will require the Reserve Center to get a WPDES permit for the wash rack discharge and require monitoring wells around the Reserve Center as a stipulation for the permit. The Reserve Center doesn't feel they can get along without the wash rack.

In terms of the monitoring well installation, Jeff is looking for three water table wells and one deeper well to detect TCE. The discussion of the location of these wells was vague but all could be installed in and around the Reserve Center, on park property.

without any problem from the City of Manitowoc. Jeff indicated the water table wells could be located to the north, south and west of the Reserve Center. I think this is to establish groundwater flow and to define the scope of the monitoring. The deeper well could be located outside the maintainance building. We agreed that Joan and I would relay this discussion to our supervisor and would provide Jeff with a response within 30 days.

The next morning, May 25, we visited the DePere AMSA shop since we were only 10 miles away. Upon our arrival we met with Art Hansen who is the Automotive Inspector. We discovered a few problems.

1. Currently they are disposing of used oil into a partially buried drum. They have no way of knowing if the drum leaks. Currently the drum is empty. Joan advised them to discontinue use of the drum and to remove it. The facility has an additional water buffalo that is used for waste oil. This is in much better shape and they should not have any problem using this instead of the buried drum. They are on DRMO's contract with Rock Oil for regular pickup of waste oil. In addition the AMSA has two Kleanflow Cleanmaster parts washers which generate about 300 gallons of waste solvent per year. Joan discussed with Art that an EPA Identification number will need to be issued and that she will send the AMSA the initial paperwork.

2. All the waste drums for solvents and other POL items are separated and marked, and transported to McCoy's DRMO for disposal when filled. They are sitting on pallets next to the fence which is adjacent to a road. The drums are rusty due to age and being exposed to the elements. Water sits on top of them. The drums are accessible to anyone. We worry about the potential of vandalism. The AMSA does not have any other space to store them. Joan felt an enclosed building with a concrete bermed floor would be the best solution.

3. The storage area for the waste products is in the back of the parking lot. The ground is sandy and we noticed numerous spots where oil or other products had been dripped. Joan advised them this must be cleaned up and turned in to DRMO as spill debris. She also advised that the ground under the partially buried drum must be cleaned if they detect oil drip spots.

Joan left Art an outline of what they need to do and agreed to call Art's supervisor to continue the discussion.

We arrived back at Fort McCoy at approximately 1pm. on Wednesday.

Lynn McIntosh

LYNN M. MCINTOSH
Env Protection Assistant
Env Mgmt & Energy Control Ofc
DEH

Joan M. Kenney

JOAN M. KENNEY
Env Protection Assistant
Env Mgmt & Energy Control Ofc
DEH

20 JUL 1990

State of Wisconsin \ DEPARTMENT OF NATURAL RESOURCES

Lake Michigan District Headquarters
1125 North Military Avenue
Box 10448
Green Bay, Wisconsin 54307-0448
Fax Number 414-497-4410

July 17, 1990 File Ref: 3300

CERTIFIED MAIL
Return Receipt Requested

Katherine Gibson
Commander USATHAMA
Attn: CETHA-IR-P
Aberdeen Proving Ground, MD 21010

Subject: Notice of Noncompliance
Review and Comments of the Draft Final Manitowoc Army Reserve Center (MARC) Site Investigation (SI) Report

Dear Ms. Gibson:

This letter outlines my review comments of your report submittal.

This report was very readable, understandable, and well received by the Department. The quality of the study was very good. The geologic interpretations are, within the limitations, thorough and quite well supported. The sample and laboratory information, as presented, indicate rather well that the wash rack/dry well, the motor vehicle storage shed, and the POL shed are not likely contributors to groundwater contamination at the facility. However, please be aware that the Department of Natural Resources is concerned about the exceedance of the state groundwater standards for 1,2-dichloroethane. This letter outlines those concerns and requests some additional work to better define groundwater quality and flow downgradient (eastward) of the septic tank and drainfield areas.

Under Chapters 144 and 147 of the State Statutes, the Department of Natural Resources is designated as the central unit of state government to protect, maintain, manage, and improve the quality of the air, land, and waters of the state. Wisconsin Department of Natural Resources Administrative Code Chapter NR 140 establishes numerical groundwater standards for the state. The enforcement standard for 1,2-dichloroethane in that code is 0.5 ug/l. The preventative action limit for 1,2-dichloroethane is 0.05 ug/l. As noted below, groundwater at this site exceeds the Chapter NR 140 enforcement standard for 1,2-dichloroethane.

The following more thoroughly elaborates the Department's concerns and requests for additional actions at the MARC:

- The septic tank and drainfield infiltrate to a perched aquifer near a groundwater divide. MW-2B, 6, and 5 encountered the aquitard clay top at approximately 33 feet, 30 feet, and 25 feet, respectively. A substantial clay layer at the MW-5T location is absent. Other than dry subsurface conditions, a truly impermeable aquitard is questionable at this location.

- MW-6 exhibits 7 vertical feet of silt and clay layers from its top at 30 feet until boring termination at 37 feet. Although visually (in-field soil description) low permeability conditions exist, this material is saturated and insitu material heterogeneities such as the interconnection of fractures and sand lenses or layers is unaccounted for. It can be presumed from the boring logs that more extensive laterally extending sand or sand and gravel layers may again appear at 5 to 15 feet below this 37'-depth.

- Ground surface seeps have been identified northeasterly of the site as perched water table discharge zones. None have been identified east or southeast of MW-6 although, as conceptualized in figure 4-6, discharge could be occurring in this direction also.

- As described in figure 5-4 and on page 5-15, 1,2-dichloroethylene would have traveled 465 feet from an origin near the septic system. This distance is 215 feet downgradient past the (MARC) property boundary and toward the Manitowoc B municipal well. 1,2-dichloroethylene was detected in only one of two groundwater sampling rounds from MW-6. However, of the four VOC compounds detected in MW-6, 1,2-dichloroethane was detected and confirmed in both sampling rounds. The reported values of 0.821 and 0.647 are above the WDNR Administrative Code Chapter NR 140 enforcement standard of 0.5 ug/l. This substance, if presented in the calculation on figure 5-4, would be estimated to have traveled 466 feet beyond the same property boundary, assuming a KOC value of 36 (Fetter, C.W. Applied Hydrogeology, 1988, page 403). This is a most conservative estimate, as alternate lower KOC estimations would predict a greater travel distance (Groundwater Chemicals Desk Reference 1990).

- MW-2A and MW-6 are each constructed so that their screen bottoms are approximately 2.7 and 2.3 feet above the underlying aquitard top. Of the six VOC compounds of concern, only vinyl chloride (sg. 0.9121) has a specific gravity of less than one (floater), while 1,2-dichloroethane (sg. 1.25); 1,2-dichloroethylene (sg. 1.28); 1,1-dichloroethane (sg. 1.17); trichloroethylene (sg. 1.46); and tetrachloroethylene (sg. 1.626) are greater than one (sinkers). These sinking compounds in proper conditions may go undetected near the aquifer bottom if the well screen does not also penetrate to the aquifer bottom. This condition can also account for sample detection variabilities in addition to those attributed to laboratory detection limits as proposed by the consultant.

A summary of the above review comments arrives at one conclusion: An additional monitoring well nest is required to the east of MW-6. This nest must be located between 300 and 500 feet downgradient of MW-6. The well nest must consist of at least a water table observation well and a deep aquifer piezometer well. Their constructions and aquifers monitored must be similar to MW-6 and MW-2B. The well nest shall also have a third or intermediary monitoring level if such saturated conditions are encountered. The well screen of the upper and intermediary aquifer must intercept their respective aquifer bottoms. The lowest level piezometer must be constructed similar to MW-2B and monitor an aquifer level comparable to the Manitowoc B Ranney well.

tilizing all previously established methods, these wells shall be sampled on he same date as MW-6. Water level readings only shall be required from all ther site monitoring wells on the same date. A groundwater map shall be ompiled which incorporates the new wells with the existing site wells. eologic cross section A-A shall be redrawn projecting the new wells, MW-6, nd MW-5 into it. Parameter analysis shall be from each well of the new well .est and MW-6. In addition to in-field water data, a VOC screen which ncludes 1,2-dichloroethane; 1,2-dichloroethylene; 1,1-dichloroethane; .richloroethylene; tetrachloroethylene; and vinyl chloride shall be performed ıtilizing the same laboratory methods and certified reporting limits not ;reater than those established previously for this project. The actual new vell locations will require prior approval from WDNR before installation. At .east 48-hour notice shall be given to WDNR prior to each drilling and ;ampling event.

\ final issue identified on page 5-3 indicates that petroleum hydrocarbon :esidues are present in soils beneath the (MARC) dry well. The concentrations ıdentified (between 40-3900 ppm) exceed the WDNR guidance criteria of 10 ppm These contaminated soils shall be removed and properly disposed of. In-field ıeadspace analysis with an Hnu or OVA is permitted. Several confirmation site wall and excavation bottom samples with laboratory analysis for total petroleum hydrocarbons are required prior to backfilling the hole. A 2-foot-thick clay cap is required over the excavated area. Prior approval by WDNR is required for the disposal of contaminated soils. These arrangements can be made at your request.

All the above requirements of this letter are to be completed by you prior to November 1, 1990. Please contact me promptly if you desire to arrange a telephone conference and/or meeting to implement these remedial and investigative actions. I can be reached at (414) 497-4336.

Sincerely,

Richard C. Stoll
District Hydrogeologist

RS:cm
cc: Bob Barnum
Bruce Urben
Jim Schedgick
Jeff Haack - GBA
Colonel Boland, Attn: AFZR-DE-E Lynn McIntosh, Department of the Army, Headquarters Fort McCoy, Sparta, WI 54656

ineers
hitects
anners
entists

Foth & Van Dyke

2737 S. Ridge Road
P. O. Box 19012
Green Bay, WI 54307-9012
414/497-2500
FAX: 414/497-8516

March 23, 1992

Mr. David Gundlach
Department of the Army
Headquarters Fort McCoy
Attn: AFZR-DE-P
Sparta, WI 54656

Dear Mr. Gundlach:

RE: Remediation Action Inspection, Manitowoc, WI
Project Number HA00021-05

INTRODUCTION

This letter report presents the results of Foth & Van Dyke's Remediation Action Inspection program in connection with the excavation of the abandoned dry well located at the Manitowoc Army Reserve Center, Manitowoc, Wisconsin. The dry well was used to receive water from a vehicle/equipment wash rack which consists of a cement pad with a floor drain which leads to the dry well. The wash rack has not been used in several years, but was previously used to service approximately 70 vehicles per year. The site location is shown in Figure 1 which is a section of USGS Manitowoc 7.5' topographic map of the area. The site layout is shown in Figure 2.

SCOPE OF WORK

Foth & Van Dyke personnel performed the following services:

- Observed and documented the excavation of the dry well.
- Collected independent samples to provide quality assurance for the remediation action.
- Verified the contractor performed work specified by project specifications.

WORK FUNCTIONS

Consultant: Foth & Van Dyke
Green Bay, WI
Field Personnel: Rebecca J. Koepke

[32-15]91F26.51

Primary Contractor: Excavation
TJ Environmental Contractors
Mequon, WI
Field Personnel: Joel Jacobson
John Fillbach
Bobby Dondlinger

Sample Collection
Environmental Associates
Mequon, WI
Field Personnel: R. Scott Bartling

The primary contractor excavated the dry well, stockpiled contaminated soil and debris, provided backfill material, backfilled the excavation, and coordinated disposal of contaminated soil and debris. Environmental Associates were contracted by the primary contractor to collect soil samples. Foth & Van Dyke verified the work of the primary contractor and collected independent samples for quality assurance.

SITE LOCATION AND TOPOGRAPHY

The Manitowoc Army Reserve Center is located on the western shore of Lake Michigan within Silver Creek Park which is within the southern city limits of Manitowoc, Wisconsin. The site is located within the SW 1/4, NW 1/4 of Section 5, T18N, R24E in Manitowoc County, as shown in Figure 1. The site is at an elevation of 650 feet above mean sea level. The site is approximately 1000 feet west of Lake Michigan and approximately 70 feet above the mean elevation of the lake.

EXCAVATION OF DRY WELL

Excavation of the dry well began on December 2, 1991. The dry well consisted of a 6 x 6 x 6 foot pit with cinder block walls with no floor. The dry well was covered by a 6 foot x 6 foot x 6 inch block of cement with an access hole in the center. The cement block was exposed approximately two inches below the ground surface. The cinder block walls extended from the base of the cement block to a depth of 6 feet below ground surface.

The center of the dry well contained wood debris, broken cinder blocks, a sediment pile and a pool of water with an oil like sheen on the surface. The area behind the cinder blocks was backfilled with a coarse, rounded gravel with sand. The lower four feet of the cinder blocks were stained black. The upper portion of the cinder blocks were lightly stained. The drain pipe which originated from the wash rack and terminated in the dry well entered the well in the southern wall approximately 1 foot below ground surface. The drain pipe was iron and the length which was exposed and removed was intact with no obvious leaks. The end of the remaining pipe was plugged.

The cinder blocks were removed and stockpiled separately from the excavated soil. The gravel backfill exposed behind the cinder blocks was stained a very dark grey. An odor of petroleum products could be smelled in the pit. Once the gravel backfill was removed, staining of the surrounding native soil was evident. The native soil was a fine to medium grained silty sand. Native soil was excavated until all visually stained soil had been removed.

The excavation extended vertically to a depth of 10 feet. Groundwater was encountered at 10 feet. A sheen formed on the groundwater which pooled in a portion of the bottom of the eastern half of the excavation. The final excavation was 16 feet x 17 feet and 10 feet in depth and 69.53 tons of soil, cement and cinder blocks were removed and disposed. Excavated soils were stockpiled separately from the cinder blocks and cement block.

After the stained soil had been removed, five soil samples were screened using a HNU photoionizer. The method used followed the jar headspace method described in Attachment 2, *Closure of Underground Storage Tanks*, Chapter ILHR 10, Wisconsin Administrative Code, Department of Industry, Labor and Human Relations. A 10.2 eV probe was used with the HNU photoionizer. The HNU calibration gas consisted of 100 ppm (parts per million) isobutylene in an air matrix. Because the ambient air temperature was 5-7 degrees Fahrenheit, the HNU was run for 30 minutes before calibration to allow the instrument to warm up. The HNU was calibrated before and after the headspace readings. Soil samples collected for headspace analysis corresponded to the soil sample collected for laboratory analysis. A sample was taken from each wall, approximately 6 feet below ground surface and one sample from the center of the floor of the excavation. All HNU readings for the samples were <1 ppm (parts per million).

Stockpiled soil and cinder blocks were stored on the northwest corner of the parking lot. The soil and blocks were placed on impermeable plastic sheeting and were covered by impermeable plastic sheeting.

RESULTS OF SOIL ANALYSIS

Soil sample locations collected for laboratory analysis by Foth & Van Dyke and by the primary contractor are shown in Figure 3. Soil samples were collected approximately six feet below the ground surface using a backhoe bucket. Field personnel did not enter the excavation due to instability of the soil. Samples collected by Foth & Van Dyke were handled in accordance with the Foth & Van Dyke *Project Quality Assurance Plan* submitted to the Department of the Army, Headquarters Fort McCoy, in December, 1991. Each soil sample was tightly packed into a 120 ml glass jar and stored on ice until arrival at ORTEK, Green Bay, Wisconsin. The five soil samples were analyzed for diesel range organics (DRO). Twenty-four hour turnaround was used to expedite the backfilling of the excavation. Laboratory results were received on December 3, 1991. Results of the laboratory analysis were reported as total petroleum hydrocarbons (TPH) as diesel and are listed below.

Soil Sample Location	TPH as Diesel (mg/kg)
SS - West Wall	<5.0
SS - East Wall	<5.0
SS - South Wall	<5.0
SS - North Wall	<5.0
SS - Floor	<5.0

TPH = Total Petroleum Hydrocarbons
< = Compound was not detected at the detection limit shown

TPH as diesel was not detected in the five soil samples. Copies of the laboratory analysis are included as Attachment 1.

BACKFILLING OF THE EXCAVATION

The excavation was backfilled on December 6, 1991 by the primary contractor. Four to five inches of snow had accumulated in the excavation. The snow was removed from the pit and the sides and the bottom of the excavation were scraped before backfilling because the contracted stated that fill material was not to be placed on frozen substrate.

The excavation was backfilled with sand obtained from the Sheboygan Sand and Gravel Company, Sheboygan, Wisconsin. The subsoil backfill was free of debris and gravel larger than three inches. No excavated material was reused as backfill material. The excavation was systematically backfilled. The backfill material was placed in the excavation in six to ten inch layers and then was compacted with the backhoe bucket. The excavated area was brought to grade with the surrounding area of the site.

The seeding of the excavated area was postponed due to the inclement weather. Seeding has tentatively been scheduled by the primary contractor for the spring of 1992.

DISPOSAL OF PETROLEUM CONTAMINATED SOIL AND BLOCKS

The 69.53 tons of soil, cement and cinder blocks removed from the excavation were disposed of at Ridgeview Recycling and Disposal Facility on February 14, 1992. A copy of a letter of receipt from Ridgeview Recycling and Disposal Facility is included in Attachment 2. A copy of the Service Agreement for non-hazardous waste disposal and the Generator's Special Waste Profile Sheet are also included in Attachment 2.

CONCLUSION

Field observations, headspace analyses, and laboratory data indicate that petroleum contaminated soil and debris have been removed from the dry well excavation. The primary contractor completed requirements in the project specifications for excavation, backfilling, and disposal of contaminated soil from the dry well area. Seeding of the excavated area has not been completed.

Sincerely,

Foth & Van Dyke

Rebecca J. Koepke
Project Geologist

Janis Schallhorn Kesy, C.P.G.
Manager, Environmental Investigations

RJK:JSK:cac

4 NOV 1992

DEPARTMENT OF THE ARMY
HEADQUARTERS FORT McCOY
SPARTA, WISCONSIN 54656-5000

REPLY TO
ATTENTION OF

October 27, 1992

Engineer Plans and
Services Division

Director of Public Works
ATTN: Mr. Michael Halley
City of Manitowoc
P.O. Box 1597
Manitowoc, Wisconsin 54221-1597

Dear Mr. Halley:

This letter is in reference to your request for access to the wells installed for the groundwater investigation at the Army Reserve Center in Manitowoc. The investigations concluded with a finding that the Army Reserve is not the source of the contamination.

The Army Reserve will officially abandon and close the wells on the property owned by the U.S. Government in Manitowoc in accordance with State regulations. Consultation with the Army Reserve (84th Division, Mr. Kampe) indicates that there are no objections to allowing you access to the wells for the purpose of monitoring the water table prior to the closure of the wells. The only requirement is that access be conducted during the normal hours of work on weekdays. The local Army Reserve Facility Manager (Mr. Steffen, telephone (414) 682-0921) will retain the keys and will open the wells for your access.

A decision is needed from you regarding the wells installed by the Army Reserve on the adjacent city park property. Specifically, a written notice is required from you requesting transfer of the wells to the city as a substitute for abandonment and closure, if this is your preference. Otherwise, action will also be initiated to close these wells. The local facility manager will retain the keys to these wells, pending a reply from you regarding transfer to the city. You will be given access to these wells under the same terms as the wells on Army Reserve property, until completion of transfer or closure action.

You may direct your reply and any questions to either Robert A. Wells at telephone (608) 388-3466 or Lynn McIntosh at telephone (608) 388-2160 in the Directorate of Engineering at Fort McCoy, Wisconsin.

Sincerely,

Marvin W. Westerburg
Lieutenant Colonel, U.S. Army
Director, Directorate of Engineering

Copies Furnished:

Cdr, 84th Div., ATTN: Mr. Kampe, WSSD, Milwaukee, WI
Army Reserve Center, ATTN: Mr. Steffen, 3125 S. 10th St., Manitowoc, WI
Off-Post Facilities Division, Fort McCoy
Environmental Management Division, Fort McCoy

MANITOWOC PUBLIC UTILITIES

1303 S. 8TH STREET • P.O. BOX 1090 • MANITOWOC, WI 54221-1090

November 23, 1992

Marvin W Westenburg
Lieutenant Colonel U S Army
Director, Directorate of Engineering
Department of the Army
Headquarters Fort McCoy
Sparta WI 54656-5000

Dear Mr. Westenburg:

In reference to your letter dated October 27, 1992 to Mr. Mike Hawley - Director of Public Works and my subsequent conversation with Ms. Lynn McIntosh, Manitowoc Public Utilities does not believe that the transfer of wells located at the Army Reserve Center in Manitowoc to the City at the present will be necessary.

Manitowoc Public Utilities anticipates the monitoring of the water table completed by late spring or early summer 1993. We are, therefore, requesting that abandonment and closure of these wells be conducted after summer 1993.

Thank you for allowing Manitowoc Public Utilities to access these wells. Should you have any questions, please feel free to call me at (414) 683-4601.

Sincerely,

nilaksh kothari

Nilaksh Kothari
Water System Manager

NK:jmk

APPENDIX D: ANNUAL CLIMATOLOGICAL SUMMARY, 1973 - 1992
U.S. DEPARTMENT OF COMMERCE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

APPENDIX D: ANNUAL CLIMATOLOGICAL SUMMARY, 1973 - 1992
U.S. DEPARTMENT OF COMMERCE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

U.S. DEPARTMENT OF COMMERCE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
NCC FORM 5443

ANNUAL CLIMATOLOGICAL SUMMARY

ENVIRONMENTAL DATA SERVICE
NATIONAL CLIMATIC CENTER

STATION NUMBER 47 5017 06 MANITOWOC WISCONSIN ELEVATION 660 FT. ABOVE SEA-LEVEL. LAT.: 44 06 N. LONG.: 87 41 W.

DATE YR	DATE MO	TEMPERATURES (°F.) MEAN MAXIMUM	MEAN MINIMUM	MEAN	DEPART. FROM NORMAL	DEGREE DAYS	HIGHEST	DATE	LOWEST	DATE	NUMBER OF DAYS MAX. ≥ 90°	MAX. ≤ 32°	MIN. ≤ 32°	MIN. ≤ 0°	PRECIPITATION (INCHES) TOTAL	DEPART. FROM NORMAL	GREATEST OBSERVED DAY	DATE	SNOW, SLEET TOTAL FALL	GREATEST DEPTH	DATE	NO OF DAYS ≥ .10	≥ .50	≥ 1.00
73	01	30.9M	15.8M	23.4M	1.5	1287	49	27+	- 7	9+	0	13	29	5	1.53	.07	.90	22	.6	4	1	5	1	0
73	02	32.4	18.1	25.3	2.2	1109	41	5	- 8	17	0	13	28	2	1.19	- .24	.31	14		4	26+	5	0	0
73	03	44.6	32.6	38.3	7.1	817	53	15+	23	21+	0	1	12	0	1.88	- .11	.62	14	.0	2	4+	4	2	0
73	04	49.0	33.1	41.1	- 2.5	712	69	21	15	11	0	0	10	0	2.69	.02	.83	21		5	10	11	1	0
73	05	60.8M	40.6M	50.7M	- 3.4	438	78	31	31	3	0	0	2	0	6.47	3.64	2.42	28	.0	0		9	4	3
73	06	78.4	54.8	66.6	2.1	33	92	12+	45	1	3	0	0	0	3.14	- .52	1.49	28	.0	0		8	1	1
73	07	80.8M	61.7M	71.3M	.3	2	93	13+	52	12	3	0	0	0	1.74	- .83	.87	12	.0	0		4	1	0
73	08	80.5M	62.3M	71.4M	1.4	5	96	27	53	3	4	0	0	0	3.44	.28	.98	17	.0	0		6	3	0
73	09	69.5	52.7	61.1	- .5	144	82	3	37	20	0	0	0	0	3.06	- .18	1.65	22	.0	0		5	1	1
73	10	62.6	46.9	54.8	3.8	310	74	25+	32	17	0	0	1	0	3.22	1.09	1.02	28	.0	0		5	4	1
73	11	44.1	29.7	36.9	- .1	834	54	14+	13	10	0	0	18	0	.96	- 1.34	.54	15	T	0		3	1	0
73	12	29.6M	17.2M	23.4M	- 2.6	1283	55	3	- 7	31	0	18		2	3.49	1.99				10	17			
73	ANN	55.3M	38.7M	47.0M	.7	6974	96	8	- 8	2	10	45		9	32.81	3.87	2.42	5		10	12			
		ANNUAL MEANS				SUM	ANNUAL EXTREMES				ANNUAL SUMS						EXTREME		SUM	EXTREME		SUMS		
		SUM	SUM	SUM	NORMAL	.7 DEP.	DIFF.	ERROR							NORMAL	DEP.	DIFF.	ERROR						

"M" = MISSING DAYS
"+" AFTER DATE = ALSO OTHER DAYS
"T" = TRACE

U.S. DEPARTMENT OF COMMERCE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
NCC FORM 9441

ANNUAL CLIMATOLOGICAL SUMMARY

ENVIRONMENTAL DATA SERVICE
NATIONAL CLIMATIC CENTER

STATION NUMBER: 47 5017 06 MANITOWOC WISCONSIN ELEVATION 660 FT. ABOVE SEA-LEVEL. LAT.: 44° 06' N LONG.: 87° 41' W

DATE		TEMPERATURES (°F.)									NUMBER OF DAYS				PRECIPITATION (INCHES)				SNOW, SLEET			NO OF DAYS		
YR	MO	MEAN MAXIMUM	MEAN MINIMUM	MEAN	DEPART. FROM NORMAL	DEGREE DAYS	HIGHEST	DATE	LOWEST	DATE	MAX. ≥ 90°	MAX. ≤ 32°	MIN. ≤ 32°	MIN. ≤ 0°	TOTAL	DEPART. FROM NORMAL	GREATEST OBSERVED DAY	DATE	TOTAL FALL	GREATEST DEPTH	DATE	≥ .10	≥ .50	≥ 1.00
74	01	26.7	13.0	19.9	- .3	1394	46	30	- 13	12	0	15	31	7	2.26	.99	.81	27		5	15+	5	1	0
74	02	29.0M	11.6M	20.3M	- 2.3	1252	45	28+	- 2	7	0	17	26	3	1.63	.48	.56	22		14	8+	6	1	0
74	03	38.6	24.1	31.4	.1	1035	64	3	- 2	24	0	3	25	1	1.36	- .62	.32	25	8.5			5	0	0
74	04	54.0	35.0M	44.5M	.4	604	80	28	21	8	0	0	11	0	2.85	.15	1.55	14		T	14+	6	1	1
74	05	61.1M	42.1	51.6M	- 2.2	407	79	22	29	7	0	0	3	0	3.56	.72	1.00	21				6	3	1
74	06	72.1	51.5	61.8	- 2.3	119	82	21	42	11	0	0	0	0	3.25	- .09	1.96	9	.0	0		8	1	1
74	07	M	M	M	M	M	M		M			0	0	0	2.84	- .19								
74	08	77.1	57.9	67.5	- 1.9	18	90	26	48	30	1	0	0	0	3.04	.27	1.01	11	.0	0		6	2	1
74	09	68.4M	46.3M	57.4M	- 3.5	236	86	8	29	23	0	0	2	0	1.01	- 2.00	.35	12	.0	0		4	0	0
74	10	57.3M	39.1M	48.2M	- 2.9	514	78	5	27	2	0	0	6	0	1.71	- .36	.53	6	T	0		4	1	0
74	11	44.9	31.1	38.0	.8	804	66	1	20	16	0	2	17	0	1.66	- .49	.81	11	T	0		4	1	0
74	12	34.6M	22.2M	28.4M	3.3	1119	42	2	11	26+	0	8	31	0	2.31	.83	.66	7	4.7	5	20+	5	3	0
74	ANN								- 13	1		45	152	11	27.48E	- .31	1.96	6						
		ANNUAL MEANS				SUM	ANNUAL EXTREMES				ANNUAL SUMS						EXTREME		SUM	EXTREME		SUMS		
		SUM	SUM	SUM	NORMAL	DEP.	DIFF.	ERROR							NORMAL	DEP.	DIFF.	ERROR						

"M" - MISSING DAYS
"+" AFTER DATE - ALSO OTHER DAYS
"T" - TRACE

U.S. DEPARTMENT OF COMMERCE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
NCC FORM 5443

ANNUAL CLIMATOLOGICAL SUMMARY

ENVIRONMENTAL DATA SERVICE
NATIONAL CLIMATIC CENTER
NOAA FORM 37-326 (11-74)

STATION NUMBER: 47 5017 06 MANITOWOC WISCONSIN ELEVATION 660 FT. ABOVE SEA-LEVEL. LAT.: 44° 06' N. LONG.: 87° 41' W.

DATE		TEMPERATURES (°F)									NUMBER OF DAYS				PRECIPITATION (INCHES)				SNOW, SLEET			NO. OF DAYS		
YR.	MO.	MEAN MAXIMUM	MEAN MINIMUM	MEAN	DEPART. FROM NORMAL	DEGREE DAYS	HIGHEST	DATE	LOWEST	DATE	MAX. ≥ 90°	MAX. ≤ 32°	MIN. ≤ 32°	MIN. ≤ 0°	TOTAL	DEPART. FROM NORMAL	GREATEST OBSERVED DAY	DATE	TOTAL FALL	GREATEST DEPTH	DATE	≥ .10	≥ .50	≥ 1.00
75	01	30.3M	14.7M	22.5M	2.3	1307	48	10	- 4	13	0	16	29	4	1.59	.32	.70	29				4	1	0
75	02	29.8M	14.1M	22.0M	- .6	1199	41	21	- 15	9	0	16	28	5	E 1.74	.59	.78	24	10.5	8	17	5	2	0
75	03	35.7M	19.3M	27.5M	- 3.8	1157	48	20	3	9	0	10	28	0	2.69	.71	1.10	22		7	11+	8	1	1
75	04	47.1	30.4	38.8	- 5.3	780	66	29	18	1	0	2	16	0	2.09	- .61	.79	28	.0			6	1	0
75	05	69.3M	47.0M	58.2M	4.4	225	85	20	32	12	0	0	1	0	3.96	1.12	1.62	30	.0	0		3	2	2
75	06	74.6	55.3	65.0	.9	71	87	23	45	8	0	0	0	0	3.83	.49	1.35	11	.0	0		9	2	1
75	07	82.3	61.7	72.0	2.0	15	94	22	48	12	2	0	0	0	3.47	.44	2.80	10	.0	0		4	1	1
75	08	79.4M	59.6M	69.5M	.1	10	90	4	49	7	1	0	0	0	9.48	6.71	4.40	28	.0	0		9	6	3
75	09	67.3M	47.8M	57.6M	- 3.3	221	80	3	34	23	0	0	0	0	1.02	- 1.99	.31	11	.0	0		4	0	0
75	10	62.2M	41.6M	51.9M	.8	404	85	13	29	30	0	0	4	0	.16	- 1.91	.16	14	.0	0		1	0	0
75	11	49.8	32.5	41.2	4.0	708	70	5	M		0	5		0	3.66	1.51	1.00	29		3	27	10	3	1
75	12	33.0	16.7	24.9	- .2	1238	58	14+	- 4	18	0	15	29	2	E 1.60	.12D	.60	20		9	27+		2	0
75	ANN	55.1M	36.7M	45.9M	.1	7335	94	7	- 15	2	3	64		11	35.29E	7.50	4.40	8					21	9
		ANNUAL MEANS				SUM	ANNUAL EXTREMES				ANNUAL SUMS						EXTREME		SUM	EXTREME		SUMS		
		SUM	SUM	SUM	NORMAL	.1 DEP.	DIFF.	ERROR							NORMAL	DEP.	DIFF.	ERROR						

"M" : MISSING DAYS
"+" AFTER DATE ALSO OTHER DAYS
"T" : TRACE

U.S. DEPARTMENT OF COMMERCE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
NCC FORM 5443

ANNUAL CLIMATOLOGICAL SUMMARY

ENVIRONMENTAL DATA SERVICE
NATIONAL CLIMATIC CENTER
NOAA FORM 27-338 (11-74)

STATION NUMBER: 47 5217 06 MANITOWOC WISCONSIN ELEVATION 660 FT. ABOVE SEA-LEVEL. LAT.: 44 06 N: LONG.: 87 41 W

DATE		TEMPERATURES (°F.)									NUMBER OF DAYS				PRECIPITATION (INCHES)				SNOW, SLEET			NO OF DAYS		
YR.	MO.	MEAN MAXIMUM	MEAN MINIMUM	MEAN	DEPART. FROM NORMAL	DEGREE DAYS	HIGHEST	DATE	LOWEST	DATE	MAX. ≥ 90°	MAX. ≤ 32°	MIN. ≤ 32°	MIN. ≤ 0°	TOTAL	DEPART. FROM NORMAL	GREATEST OBSERVED DAY	DATE	TOTAL FALL	GREATEST DEPTH	DATE	≥ .10	≥ .50	≥ 1.00
76	01	25.2M	3.8M	15.5M	- 4.7	1526	37	2	- 15	8	0	25	31	10 E	1.95	.68	.34	21		21	31+		0	0
76	02	34.4M	18.9M	26.7M	4.1	1104	48	25+	- 12	2	0	7	28	4	1.82	.67	.75	21		24	5	3	2	0
76	03	41.7	24.6	33.2	1.9	976	65	24	6	6	0	8	25	0	5.05	3.07	1.38	4		7	10+	7	4	2
76	04	54.4	34.9	44.7	.6	602	70	15	23	12	0	0	15	0	3.33	.63	.76	24	.0	0		10	3	0
76	05	63.0	41.1	52.1	- 1.7	392	80	20	30	12+	0	0	4	0	3.55	.71	1.00	16	T	0		8	3	1
76	06	79.4	56.0	67.7	3.6	32	92	26+	45	2	5	0	0	0	1.40	- 1.94	.93	14	.0	0		3	1	0
76	07	83.4	60.0	71.7	1.7	3	97	14	50	13	5	0	0	0	3.87	.84	2.02	28	.0	0		3	3	2
76	08	80.0M	56.6M	68.3M	- 1.1	35	96	27	45	15	4	0	0	0	.76	- 2.01	.44	28	.0	0		2	0	0
76	09	71.5M	48.5M	60.0M	- .9	191	92	7	32	28+	1	0	2	0	.72	- 2.29	.40	1	.0	0		2	0	0
76	10	53.9M	36.0M	45.0M	- 6.1	613	75	12	23	28	0	0	9	0	1.95	- .12	.73	5	T	0		4	2	0
76	11	38.0	21.0	29.5	- 7.7	1056	57	2	- 7	29	0	7	26	3 E	.34	- 1.81	.20	27	3.0	2	28+	2	0	0
76	12	23.3M	4.3M	13.8M	-11.3	1580	40	14	- 15	29+	0	22	31	12	.46	- 1.02	.19	6	4.7	7	16+	1	0	0
76	ANN.	54.0M	34.0M	44.0M	- 1.8	8110	97	7	- 15	12+	15	69	171	29	25.20E	- 2.59	2.02	7		24	2		18	5
		ANNUAL MEANS				SUM	ANNUAL EXTREMES				ANNUAL SUMS						EXTREME		SUM	EXTREME		SUMS		
						- 1.8																		
		SUM	SUM	SUM	NORMAL	DEP.	DIFF.	ERROR							NORMAL	DEP.	DIFF.	ERROR						

"M" - MISSING DAYS
"+" AFTER DATE ALSO OTHER DAYS
"T" - TRACE

U.S. DEPARTMENT OF COMMERCE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
NOC FORM 5443

ANNUAL CLIMATOLOGICAL SUMMARY

ENVIRONMENTAL DATA SERVICE
NATIONAL CLIMATIC CENTER
NOAA FORM 27-32 (11-74)

STATION NUMBER: 47 50 7 02 MANITOWOC WISCONSIN ELEVATION 660 FT. ABOVE SEA-LEVEL. LAT.: 44 06 N LONG.: 87 41 W

DATE		TEMPERATURES (°F.)									NUMBER OF DAYS				PRECIPITATION (INCHES)				SNOW, SLEET			NO. OF DAYS		
YR.	MO.	MEAN MAXIMUM	MEAN MINIMUM	MEAN	DEPART. FROM NORMAL	DEGREE DAYS	HIGHEST	DATE	LOWEST	DATE	MAX. ≥ 90°	MAX. ≤ 32°	MIN. ≤ 32°	MIN. ≤ 0°	TOTAL	DEPART. FROM NORMAL	GREATEST OBSERVED DAY	DATE	TOTAL FALL	GREATEST DEPTH	DATE	≥ .10	≥ .50	≥ 1.00
77	01	19.1	- 2.4	8.4	-13.8	1816	32	24	- 18	16	0	31	31	20	.59	- .68	.14	10	11.3	9	31+	3	0	0
77	02	31.1	14.3	22.7	.1	1178	48	10	5	7+	0	15	27	4	.85	- .30	.43	23	1.5	9	8+	3	0	0
77	03	44.3	29.3	37.3	6.0	850	62	29	10	1	0	0	22	0	5.19	3.21	1.02	4	4.0	3	18	9	5	1
77	04	53.3	35.0	46.7	2.6	544	83	11	18	7+	0	0	12	0	2.36	- .34								0
77	05	73.7	48.2	60.6	6.8	163	89	13	30	9	0	0	2	0	1.19	- 1.65	.57	31	.0	0		2	1	0
77	06	72.6	51.6	62.1	- 2.0	139	86	4	37	9	0	0	0	0	3.11	- .23	.89	28	.0	0		9	2	0
77	07	82.2	59.4	70.8	.8	8	98	19+	43	31	5	0	0	0	2.97	- .46	1.15	7	.0	0		8	2	1
77	08	75.6M	54.4	65.0M	- 4.4	55	88	8	45	18	0	0	0	0	3.46	.69	.79	28	.0	0		9	2	0
77	09	66.6	53.4	61.0	.1	121	79	4	45	15+	0	0	0	0	3.40	.39	1.32	24	.0	0		9	2	1
77	10	58.4M	40.0M	49.2M	- 1.9	476	67	4	27	13	0	0	6	0	1.11	- .96	.39	1	.0	0		3	0	0
77	11	46.9	29.0	38.0	.8	807	68	3	0	26	0	4	19	1	2.84	.69	.87	1		6	29+	8	1	0
77	12	32.7M	14.0M	23.4M	- 1.7	1260	51	18	- 10	11	0	12	26	9	2.37	.89	.88	20		6	5+	7	2	0
77	ANN.	55.0M	35.5M	45.3M	- .5	7417	98	7	- 18	1	5	62	145	34	29.04	1.25	1.32	9		9	2+			3
		ANNUAL MEANS				SUM	ANNUAL EXTREMES				ANNUAL SUMS						EXTREME		SUM	EXTREME		SUMS		
		SUM	SUM	SUM	NORMAL	- .5 DEP.	DIFF.	ERROR							NORMAL	DEP.	DIFF.	ERROR						

"M": MISSING DAYS
"," AFTER DATE ALSO OTHER DAYS
"T": TRACE

U.S. DEPARTMENT OF COMMERCE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
NCC FORM 9443

ANNUAL CLIMATOLOGICAL SUMMARY

ENVIRONMENTAL DATA SERVICE
NATIONAL CLIMATIC CENTER
NOAA FORM 37-320 (11-74)

STATION NUMBER: 47 9017 06 MANITOWOC WISCONSIN ELEVATION 660 FT. ABOVE SEA-LEVEL. LAT.: 44 06 N: LONG.: 87 41 W

DATE		TEMPERATURES (°F)									NUMBER OF DAYS				PRECIPITATION (INCHES)				SNOW, SLEET			NO OF DAYS		
YR	MO	MEAN MAXIMUM	MEAN MINIMUM	MEAN	DEPART. FROM NORMAL	DEGREE DAYS	HIGHEST	DATE	LOWEST	DATE	MAX. ≥ 90°	MAX. ≤ 32°	MIN. ≤ 32°	MIN. ≤ 0°	TOTAL	DEPART. FROM NORMAL	GREATEST OBSERVED DAY	DATE	TOTAL FALL	GREAT. EST DEPTH	DATE	≥ .10	≥ .50	≥ 1.00
78	01	25.7M	7.7M	16.7M	- 3.5	1491	42	7	- 6	30	0	26	31	6	2.09	.82	1.10	26		16	31+	6	1	1
78	02	25.6	7.1	16.5	- 6.1	1350	35	14+	- 3	3	0	23	28	3	.34	- .81	.10	24				1	0	0
78	03	39.5	20.1	29.8	- 1.5	1085	55	29	0	5+	0	7	27	2	.31	- 1.67	.25	14	1.0	8	8+	1	0	0
78	04	52.6M	32.6M	42.6M	- 1.5	666	66	28+	25	16	0	0	13	0	3.94	1.24	.90	6	T	0		8	3	0
78	05	68.1M	44.5M	56.3M	2.5	282	89	19	27	1	0	0	2	0	5.52	2.68	2.40	13	.0	0		4	3	2
78	06	74.0M	50.7M	62.4M	- 1.7	120	M		40	14		0	0	0	5.12	1.78	1.22	18	.0	0		8	4	2
78	07	76.6	56.3M	66.5M	- 3.5	46	93	19	47	30+	1	0	0	0	4.11	1.08	1.07	1	.0	0		8	3	1
78	08	78.0M	58.6M	68.3M	- 1.1	8	89	8	49	4	0	0	0	0	1.41	- 1.36	.40	16	.0	0		4	0	0
78	09	75.4	54.8	65.1	4.2	79	91	10	39	28	1	0	0	0	5.40	2.39	2.30	18	.0	0		8	3	2
78	10	59.0	39.9	49.5	- 1.6	474	75	21	30	27	0	0	5	0	2.41	.34	1.24	5	.0	0		5	1	1
78	11	45.2	28.6	36.9	- .3	838	73	3	5	30	0	5	20	0	2.48	.33	1.10	17				4	2	1
78	12	29.2	12.9	21.1	- 4.0	1354	49	24	- 8	10	0	14	31	3	2.95	1.47	1.34	30		14	31	7	1	1
78	ANN	54.1M	34.5M	44.3M	- 1.5	7793	93	7	- 8	12		75	157	14	36.08	8.29	2.40	5				64	21	11
		ANNUAL MEANS				SUM	ANNUAL EXTREMES				ANNUAL SUMS				EXTREME				SUM	EXTREME		SUMS		
						- 1.5																		
		SUM	SUM	SUM	NORMAL	DEP.	DIFF.	ERROR							NORMAL	DEP.	DIFF.	ERROR						

"M" MISSING DAYS
"," AFTER DATE ALSO OTHER DAYS
"T" TRACE

U.S. DEPARTMENT OF [redacted]
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
NCC FORM 9445

ANNUAL CLIMATOLOGICAL SUMMARY

ENVIRONMENTAL [redacted]
NATIONAL CLIMATIC [redacted]
NOAA FORM 27-320 (11-74)

STATION NUMBER: 47 5[redacted]17 06 MANITOWOC WISCONSIN ELEVATION 660 FT. ABOVE SEA LEVEL LAT.: 44 06 N LONG.: 87 41 W

DATE		TEMPERATURES (°F)									NUMBER OF DAYS				PRECIPITATION (INCHES)				SNOW, SLEET			NO OF DAYS		
YR	MO	MEAN MAXIMUM	MEAN MINIMUM	MEAN	DEPART. FROM NORMAL	DEGREE DAYS	HIGHEST	DATE	LOWEST	DATE	MAX. ≥ 90°	MAX. ≤ 32°	MIN. ≤ 32°	MIN. ≤ 0°	TOTAL	DEPART. FROM NORMAL	GREATEST OBSERVED DAY	DATE	TOTAL FALL	GREATEST DEPTH	DATE	≥ .10	≥ .50	≥ 1.00
7[redacted]	01	17.3	2.2	9.8	-10.4	1709	31	28+	- 17	11	0	31	31	15	3.17	1.90	1.30	24		41	30+	8	2	1
7[redacted]	02	22.1	4.2	13.2	- 9.4	1448	40	24	- 16	5	0	21	28	10	1.98	.83	.70	11		57	21	5	2	0
7[redacted]	03	38.2	23.1M	30.7M	- .6	1061	51	30	1	11	0	5	24	0	4.63	2.65	1.25	30	7.0			7	3	3
7[redacted]	04	47.8	30.9	39.4	- 4.7	763	67	25	3	5	0	0	13	0	3.00	.30	.95	12		2	2	7	2	0
7[redacted]	05	60.5M	41.8M	51.2M	- 2.6	424	73	31+	30	5	0	0	2	0	2.14	- .70	.68	19+	.0	0		6	2	0
7[redacted]	06	73.9	50.5	62.2	- 1.9	121	90	16	41	25+	1	0	0	0	3.15	- .19	.74	29	.0	0		7	3	0
7[redacted]	07	80.1	58.7	69.4	- .6	19	89	15	49	18+	0	0	0	0	1.46	- 1.57	.39	25	.0	0		5	0	0
7[redacted]	08	76.0M	58.2	67.1M	- 2.3	28	90	7	46	15	1	0	0	0	3.25	.48	1.07	4	.0	0		7	2	1
7[redacted]	09	74.2	51.1	62.7	1.8	94	83	26+	36	19	0	0	0	0	.16	- 2.85	.16	13	.0	0		1	0	0
7[redacted]	10	57.3	36.9	48.1	- 3.0	517	76	21	26	14	0	0	7	0	2.55	.48	.80	22	T	0		6	3	0
7[redacted]	11	43.9M	28.7M	36.3M	- .9	849	60	18	13	11	0	2	21	0	1.32	- .83	.39	21	T	0		5	0	0
7[redacted]	12	38.9	22.5	30.7	5.6	1057	52	15+	- 2	17	0	6	25	1	1.65	.17	.75	24	.5			5	1	0
7[redacted]	ANN	52.5M	34.2M	43.4M	- 2.4	8089	90	8+	- 17	1	2	65	151	26	28.46	.67	1.30	1				69	20	5
		ANNUAL MEANS				SUM	ANNUAL EXTREMES				ANNUAL SUMS						EXTREME		SUM	EXTREME		SUMS		
		SUM	SUM	SUM	NORMAL	- 2.4 DEP.	DIFF.	ERROR							NORMAL	DEP.	DIFF.	ERROR						

"M" - MISSING DAYS
"+" - AFTER DATE - ALSO OTHER DAYS
"T" - TRACE

U.S. DEPARTMENT OF COMMERCE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
NCC FORM 9443

ANNUAL CLIMATOLOGICAL SUMMARY

ENVIRONMENTAL DATA SERVICE
NATIONAL CLIMATIC CENTER
NOAA FORM 27-326 (11-74)

STATION NUMBER: 47 5017 06 MANITOWOC WISCONSIN ELEVATION 660 FT. ABOVE SEA-LEVEL. LAT.: 44° 06' N LONG.: 87° 41' 000

DATE		TEMPERATURES (°F)									NUMBER OF DAYS				PRECIPITATION (INCHES)				SNOW, SLEET			NO OF DAYS			
YR	MO	MEAN MAXIMUM	MEAN MINIMUM	MEAN	DEPART. FROM NORMAL	DEGREE DAYS	HIGHEST	DATE	LOWEST	DATE	MAX. ≥ 90°	MAX. ≤ 32°	MIN. ≤ 32°	MIN. ≤ 0°	TOTAL	DEPART. FROM NORMAL	GREATEST OBSERVED DAY	DATE	TOTAL FALL	GREATEST DEPTH	DATE	≥ .10	≥ .50	≥ 1.00	
80	01	27.2	13.0	20.1	- .1	1384	48	11	- 8	9	0	19	29	7	1.17	- .10	.56	16	4.0			3	1	0	0
80	02	27.7	11.3	19.5	- 3.1	1311	40	20	- 3	29	0	21	28	2	.36	- .79	.11	5				1	0	0	0
80	03	36.4	20.0	28.2	- 3.1	1135	49	21	2	7	0	7	27	0	.95	- 1.03	.50	23				4	1	0	0
80	04	55.8M	34.8M	45.3M	1.2	581	90	22	25	16	1	0	12	0	3.23	.63	.89	8	6.0			8	2	0	2
80	05	68.9	46.3	57.6	3.8	246	87	4	32	9	0	0	1	0	2.04	- .80	.93	30	T	0		4	1	0	22
80	06	75.2	50.4	62.8	- 1.3	108	89	26	35	10	0	0	0	0	5.02	1.68	1.43	28	.0	0		7	4	2	50
80	07	81.0M	59.7	70.4M	.4	4	92	16	51	1	3	0	0	0	2.64	- .39	.82	20	.0	0		6	2	0	179
80	08	78.8M	60.9M	69.9M	.5	6	88	1	52	16	0	0	0	0	5.32	2.65	1.46	20	.0	0		11	4	2	164
80	09	70.9	51.8M	61.4M	.5	136	84	5	39	26	0	0	0	0	3.80	.79	1.10	12	.0	0		10	3	1	31
80	10	54.1	38.0	46.1	- 5.0	581	71	8	24	29	0	0	9	0 E	2.15	.08	1.33	14	.0	0		4	1	1	0
80	11	44.2M	30.3	37.3M	.1	832	60	3	21	11	0	0	22	0	1.55	- .60	.68	13	T	0		5	1	0	0
80	12	31.4	16.8	24.1	- 1.0	1259	45	6	- 7	25	0	16	29	3	2.36	.88	.75	2	16.3			7	1	0	0
80	ANN	54.3M	36.1M	45.2M	- .6	7583	92	7	- 8	1	4	63	157	12	30.59E	2.80	1.46	8				70	21	6	448
		ANNUAL MEANS				SUM	ANNUAL EXTREMES				ANNUAL SUMS						EXTREME		SUM	EXTREME		SUMS			
						- .6																			
		SUM	SUM ÷	SUM	NORMAL	DEP.	DIFF.	ERROR							NORMAL	DEP.	DIFF.	ERROR							

"M": MISSING DAYS
"E": AFTER DATE ALSO OTHER DAYS
"T": TRACE

U.S. DEPARTMENT OF COMMERCE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
NCC FORM 5443

ANNUAL CLIMATOLOGICAL SUMMARY

ENVIRONMENTAL DATA SERVICE
NATIONAL CLIMATIC CENTER
NOAA FORM 27-328 (11-74)

STATION NUMBER: 47 5017 06 MANITOWOC WISCONSIN ELEVATION 660 FT. ABOVE SEA-LEVEL. LAT.: 44° 06' N: LONG.: 87° 41' 000

DATE		TEMPERATURES (°F)									NUMBER OF DAYS				PRECIPITATION (INCHES)				SNOW, SLEET			NO OF DAYS			
YR	MO.	MEAN MAXIMUM	MEAN MINIMUM	MEAN	DEPART. FROM NORMAL	DEGREE DAYS	HIGHEST	DATE	LOWEST	DATE	MAX. ≥ 90°	MAX. ≤ 32°	MIN. ≤ 32°	MIN. ≤ 0°	TOTAL	DEPART. FROM NORMAL	GREATEST OBSERVED DAY	DATE	TOTAL FALL	GREATEST DEPTH	DATE	≥ .10	≥ .50	≥ 1.00	
81	01	26.3	10.6	18.5	- 1.7	1434	42	26	- 12	4	0	21	31	7	.06	- 1.21	.03	27+	.8			0	0	0	0
81	02	32.3	17.3	24.8	2.2	1118	52	17+	- 9	3	0	12	23	4	2.76	1.61	1.02	27	9.5			7	2	1	0
81	03	44.0	25.9	35.0	3.7	924	60	29	14	3	0	2	28	0	.69	- 1.29	.26	6		0		3	0	0	0
81	04	54.7	35.9	45.3	1.2	584	77	18	27	15	0	0	7	0	6.18	3.48	1.50	19	.0	0		10	5	2	0
81	05	64.6M	41.2	52.9M	- .9	366	84	29	27	6	0	0	6	0	.60	- 2.24	.30	24	.0	0		2	0	0	4
81	06	76.2	52.3M	64.3M	.2	63	88	5	45	23+	0	0	0	0	5.03	1.69	1.66	16	.0	0		9	3	1	43
81	07	79.8	59.0	69.4	- .6	15	92	8	49	29	4	0	0	0	2.34	- .69	.70	28	.0	0		5	3	0	159
81	08	76.7	60.2	68.5	- .9	13	84	13+	48	18+	0	0	0	0	7.68	4.91	2.25	7	.0	0		10	4	3	127
81	09	69.1	50.6	59.9	- 1.0	176	86	11	37	23	0	0	0	0	4.73	1.72	1.09	30	.0	0		8	3	1	28
81	10	53.8M	38.2	46.0M	- 5.1	584	62	31	22	24	0	0	6	0	3.18	1.11	1.02	18	T	0		7	3	1	0
81	11	47.6	30.9	39.3	2.1	765	63	1	15	23+	0	1	16	0	1.18	- .97	.67	26	.0	0		3	1	0	0
81	12	33.3	16.5	24.9	- .2	1236	43	1	0	21	0	15	30	1	.68	- .80	.24	1	5.2			3	0	0	0
81	ANN	54.9M	36.6M	45.7M	- .1	7278	92	7	- 12	1	4	51	147	12	35.11	7.32	2.25	8				67	24	9	361
		ANNUAL MEANS				SUM	ANNUAL EXTREMES				ANNUAL SUMS						EXTREME		SUM	EXTREME		SUMS			
		SUM	SUM	SUM	NORMAL	- .1 DEP.	DIFF.	ERROR							NORMAL	DEP.	DIFF.	ERROR							

"M" - MISSING DAYS
"+" - AFTER DATE - ALSO OTHER DAYS
"T" - TRACE

U.S. DEPARTMENT OF COMMERCE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

ANNUAL CLIMATOLOGICAL SUMMARY

NATIONAL CLIMATIC DATA CENTER
FEDERAL BUILDING
ASHEVILLE, NORTH CAROLINA
28801

STATION IDENTIFICATION

47065017 MANITOWOC WISCONSIN ELEVATION 660 FT. ABOVE SEA LEVEL LAT. 44 6N LONG. 87 41M

DATE		TEMPERATURE (°F)														PRECIPITATION (INCHES)								
												NUMBER OF DAYS								SNOW, SLEET			NO. OF DAYS		
YR.	MO.	MEAN MAXIMUM	MEAN MINIMUM	MEAN	DEPART. FROM NORMAL	HEATING DEGREE DAYS	COOLING DEGREE DAYS	HIGHEST	DATE	LOWEST	DATE	MAX ≥ 90°	MAX ≤ 32°	MIN ≤ 32°	MIN ≤ 0°	TOTAL	DEPART. FROM NORMAL	GREATEST OBSERVED DAY	DATE	TOTAL FALL	MAX DEPTH	DATE	≥.10	≥.50	≥1.0
82	1	23.2	.7	12.0	-8.2	1639	0	40	1	-26	10	0	20	31	13	1.55	.28	.50	1	8.0M	30	21	6	1	0
82	2	29.9	11.9	20.9	-1.7	1230	0	43	20	-14	6	0	15	28	7	.29	-.86	.25	5	.0M	30	5	1	0	0
82	3	38.7	22.8	30.8	-.5	1053	0	58M	31	0M	8	0	8	28	1	1.55	-.43	.42	16	M	0		6	0	0
82	4	52.0	29.3	40.7	-3.4	724	0	71	24	5	4•	0	2	18	0	2.02	-.68	.91	3	2.5	2	3	5	1	0
82	5	66.9	46.4	56.7	2.9	254	1	80	11	37	21	0	0	0	0	3.52	.68	1.68	22	.0	0		4	2	1
82	6	70.6	47.3	59.0	-5.1	181	5	84	7	38	4	0	0	0	0	2.03	-1.31	.70	25	.0	0		6	1	0
82	7	78.8	58.7	68.8	-1.2	11	136	89M	12•	48M	2	0	0	0	0	2.60	-.43	.98	18	.0	0		6	2	0
82	8	77.4	56.2	66.8	-2.6	41	104	94	3	45	29•	1	0	0	0	3.48	.71	1.03	4	.0	0		6	4	1
82	9	66.6	50.3	58.5	-2.4	203	16	78M	5	38M	16	0	0	0	0	1.56	-1.45	.90	1	.0	0		5	1	0
82	10	58.7	42.3	50.5	-.6	443	0	72	7	26	23	0	0	5	0	2.47	.40	1.32	19	.0	0		7	1	1
82	11	42.5	29.3	35.9	-1.3	864	0	55	8	12	27	0	3	19	0	3.49	1.34	.90	10	.0T	0T	30•	8	2	0
82	12	38.0	25.4	31.7	6.6	1024	0	58	25	6	13•	0	9	22	0	2.13	.65	.85	2	M	M		7	1	0
	ANN.	53.6	35.0	44.4	-1.5	7667	262	94MAUG		-26MJAN		1	57	151	21	26.69	-1.10	1.68	MAY	10.9M	30M	FEB•	67	16	3

M MISSING DATA. APPEARS WITH MONTHLY DATA WHEN LESS THAN 10 DAYS ARE MISSING, AND IT APPEARS ALONE IF 10 OR MORE DAYS ARE MISSING. IT APPEARS WITH ANNUAL DATA, WHEN DERIVED FROM MONTHS WITH MISSING DATA.

• OCCURRED ON ONE OR MORE PREVIOUS DATES DURING THE MONTH.

T TRACE

V INCLUDES TOTAL FOR PREVIOUS MONTH.

B ADJUSTED MONTHLY OR ANNUAL VALUE TOTAL CONTAINS ESTIMATED VALUE(S) FOR MISSING DATA.

A AMOUNT PRECIPITATION MAY INCLUDE PRECIPITATION THAT OCCURRED DURING THE PREVIOUS MONTHS.

U.S. DEPARTMENT OF COMMERCE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

ANNUAL CLIMATOLOGICAL SUMMARY

NATIONAL CLIMATIC DATA CENTER
FEDERAL BUILDING
ASHEVILLE, NORTH CAROLINA
28801

STATION IDENTIFICATION

47065017 MANITOWOC WISCONSIN ELEVATION 660 FT. ABOVE SEA LEVEL LAT. 44 6N LONG. 87 41W

DATE		TEMPERATURE (°F)										NUMBER OF DAYS				PRECIPITATION (INCHES)				SNOW, SLEET			NO. OF DAYS		
YR	MO	MEAN MAXIMUM	MEAN MINIMUM	MEAN	DEPART FROM NORMAL	HEATING DEGREE DAYS	COOLING DEGREE DAYS	HIGHEST	DATE	LOWEST	DATE	MAX ≥ 90°	MAX ≤ 32°	MIN ≤ 32°	MIN ≤ 0°	TOTAL	DEPART. FROM NORMAL	GREATEST OBSERVED DAY	DATE	TOTAL FALL	MAX DEPTH	DATE	≥ .10	≥ .50	≥ 1.0
83	1	30 3	18 7	24 5	6 2	1248	0	41	10	0	27	0	16	31	1	.84	-.46	.54	14	5.3	3	22•	3	1	0
83	2	35 0	22 1	28 6	6 7	1012	0	37	28•	-1	8	0	12	26	1	.96M	M	.67	3	M	M		3	1	0
83	3	39 1	26 1	32 6	1 7	997	0	53	7•	10	23	0	6	25	0	1.611	M	.65	19	M	8	21	5	1	0
83	4	M	32 8	M				65	27	20	12	0	0	13	0	1.55	-1.27	.65	9	M	0		4	1	0
83	5	M	40 6	M				54	2	30	17•	0	0	4	0	4.04	1.12	1.15	19	.0	0		7	4	1
83	6	76 6	53 7	65 2	1 3	68	79	95	26	43	6	1	0	0	0	1.41	-1.73	1.25	27	.0	0		2	1	1
83	7	83 9	63 0	73 5	3 8	13	282	95	14	44	6	4	0	0	0	2.93	-.27	1.12	20	.0	0		5	3	1
83	8	82 5	60 5	71 5	2 7	14	222	94M	19	45M	12	4	0	0	0	2.94	-.17	1.22	30	.0	0		4	3	1
83	9	71 6	51 4	61 5	6	169	74	97	10	36	23	2	0	0	0	2.22	-.57	.52	20	.0	0		7	2	0
83	10	58 2	43 6	50 9	6	432	3	74	3	29	30	0	0	2	0	1.77	-.47	.62	12	.0	0		4	1	0
83	11	45 9	31 8	38 9	2 0	778	0	59	3•	17	30	0	1	16	0	3.69	1.64	.92	28	M	M		8	2	0
83	12	21 7	5 4	13 6	-11 1	1591	0	42	14	-21	24	0	24	31	13	1.94	.14	.35	15	3.0M	7	28	7	0	0
	ANN	M	37 5	M	M	M	M	97	SEP	-21	DEC	11	59	148	15	25.90M	M	1.25	JUN	8.3M	8M	MAR	59	20	4

M MISSING DATA APPEARS WITH MONTHLY DATA WHEN LESS THAN 10 DAYS ARE MISSING, AND IT APPEARS ALONE IF 10 OR MORE DAYS ARE MISSING IT APPEARS WITH ANNUAL DATA, WHEN DERIVED FROM MONTHS WITH MISSING DATA

• OCCURRED ON ONE OR MORE PREVIOUS DATES DURING THE MONTH.

T TRACE

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B ADJUSTED MONTHLY OR ANNUAL VALUE TOTAL CONTAINS ESTIMATED VALUE(S) FOR MISSING DATA.

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U S DEPARTMENT OF COMMERCE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

ANNUAL CLIMATOLOGICAL SUMMARY

NATIONAL CLIMATIC DATA CENTER
FEDERAL BUILDING
ASHEVILLE, NORTH CAROLINA
28801

STATION IDENTIFICATION

47065017 MANITOWOC WISCONSIN ELEVATION 660 FT. ABOVE SEA LEVEL LAT. 44 6N LONG. 87 41W

DATE		TEMPERATURE (°F)										NUMBER OF DAYS				PRECIPITATION (INCHES)				SNOW, SLEET			NO. OF DAYS		
YR	MO	MEAN MAXIMUM	MEAN MINIMUM	MEAN	DEPART. FROM NORMAL	HEATING DEGREE DAYS	COOLING DEGREE DAYS	HIGHEST	DATE	LOWEST	DATE	MAX ≥ 90°	MAX ≤ 32°	MIN ≤ 32°	MIN ≤ 0°	TOTAL	DEPART. FROM NORMAL	GREATEST OBSERVED DAY	DATE	TOTAL FALL	MAX DEPTH	DATE	≥.10	≥.50	≥1.0
84	1	23.8	6.7	15.3	-3.0	1539	0	37	24*	-19	21	0	23	31	9	1.00	-.30	.35	28	5.8M	10	12	3	0	0
84	2	37.1	21.9	29.5	7.6	1023	0	57	23	2	8	0	9	23	0	1.92	.67	.75	13	1.0	12	5*	5	2	0
84	3	33.8	19.4	26.6	-4.3	1184	0	43	25	0	7	0	13	31	1	1.84	-.37	.55	20	M	3	12	5	1	0
84	4	51.0	35.9	43.5	-.1	641	0	63	28*	27	7	0	0	6	0	4.54	1.72	1.50	22	.0	0		10	3	2
84	5	62.3	41.3	51.8	-2.4	402	0	76	31	30	2	0	0	2	0	3.13	.21	1.05	25	.0	0		5	3	1
84	6	77.4	52.6	65.0	1.1	54	62	90	9	42	2	1	0	0	0	4.75	1.61	1.60	17	.0	0		9	4	2
84	7	80.0	59.1	69.6	-.1	7	156	92	23	48	7	1	0	0	0	2.43	-.77	1.35	11	.0	0		5	2	1
84	8	80.8	61.5	71.2	2.4	11	209	89	6	47	25	0	0	0	0	3.56	.45	.62	8	.0	0		8	5	0
84	9	67.5	50.0	58.8	-2.1	183	5	77	13	32	29	0	0	1	0	3.78	.99	.85	2	.0	0		10	3	0
84	10	58.1	44.3	51.2	.9	422	0	69	16	27	29	0	0	4	0	2.34	.10	.62	9	.0	0		9	1	0
84	11	44.5	27.9	36.2	-.7	859	0	59M	4	15M	21	0	1	24	0	2.80	.75	1.00	1	.0T	0T	30*	4	3	1
84	12	35.3	18.5	26.9	2.2	1176	0	62	29*	-6	25	0	13	29	2	1.36M	M	.35	14	7.5M	M		5	0	0
	AVG.	54.3	36.6	45.5	.1	7501	432	92	JUL	-19	JAN	2	59	151	12	33.45M	M	1.60	JUN	14.3M	12M	FEB	78	27	7

M MISSING DATA. APPEARS WITH MONTHLY DATA WHEN LESS THAN 10 DAYS ARE MISSING, AND IT APPEARS ALONE IF 10 OR MORE DAYS ARE MISSING. IT APPEARS WITH ANNUAL DATA, WHEN DERIVED FROM MONTHS WITH MISSING DATA.

* OCCURRED ON ONE OR MORE PREVIOUS DATES DURING THE MONTH.

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Y INCLUDES TOTAL FOR PREVIOUS MONTH.

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A AMOUNT PRECIPITATION MAY INCLUDE PRECIPITATION THAT OCCURRED DURING THE PREVIOUS MONTHS.

U.S. DEPARTMENT OF COMMERCE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

ANNUAL CLIMATOLOGICAL SUMMARY

NATIONAL CLIMATIC DATA CENTER
FEDERAL BUILDING
ASHEVILLE, NORTH CAROLINA
28801

STATION IDENTIFICATION

47065017 MANITOWOC WISCONSIN ELEVATION 660 FT. ABOVE SEA LEVEL LAT. 44 6N LONG. 87 41W

DATE		TEMPERATURE (°F)														PRECIPITATION (INCHES)								
												NUMBER OF DAYS								SNOW, SLEET			NO. OF DAYS		
YR.	MO.	MEAN MAXIMUM	MEAN MINIMUM	MEAN	DEPART. FROM NORMAL	HEATING DEGREE DAYS	COOLING DEGREE DAYS	HIGHEST	DATE	LOWEST	DATE	MAX ≥ 90°	MAX ≤ 32°	MIN ≤ 32°	MIN ≤ 0°	TOTAL	DEPART. FROM NORMAL	GREATEST OBSERVED DAY	DATE	TOTAL FALL	MAX DEPTH	DATE	≥.10	≥.50	≥1.0
85	1	24.4M	5.6	15.0M	-3.3	1525B	0B	34	5	-25	20	0	28	31	8	1.29	-.01	.46	1	M	M		4	0	0
85	2	26.6	11.9	19.3	-2.6	1275	0	47	28	-18	1	0	20	26	6	2.45	1.20	.56	11	5.5M	25	12	8	3	0
85	3	43.9	27.4	35.7	4.8	904	0	60	27	9	6	0	2	26	0	2.70	.49	.76	31	M	6	7+	7	2	0
85	4	56.4	36.1	46.3	2.7	553	0	80	18	22	9	0	0	10	0	3.36	.54	.75	6	.0T	M		9	2	0
85	5	69.3	46.2	57.8	3.6	225	7	82	25	36	2+	0	0	0	0	1.14	-1.78	.37	26	.0	0		3	0	0
85	6	71.5	51.0	61.3	-2.6	132	27	87	24	43	13+	0	0	0	0	1.36	-1.78	.59	22	.0	0		6	1	0
85	7	78.9	59.7	69.3	-.4	6	147	90	19	53	23+	1	0	0	0	3.45	.25	2.12	25	.0	0		2	2	2
85	8	75.7	57.4	66.6	-2.2	39	95	88	6+	49	23+	0	0	0	0	5.25	2.14	1.79	25	.0	0		7	3	2
85	9	69.3	52.2	60.8	-.1	188	70	87	3	33	25	0	0	0	0	3.12	.33	1.38	5	.0	0		9	1	1
85	10	57.2	41.5	49.4	-.9	479	0	71	26	31	16	0	0	2	0	3.28	1.04	1.26	4	.0	0		7	2	1
85	11	40.6	27.8	34.2	-2.7	916	0	54	2+	5	24	0	5	16	0	6.20	4.15	1.54	2	4.2M	1	30+	10	4	2
85	12	21.3	4.2	12.8	-11.9	1617	0	36	1	-13	14	0	25	31	16	3.76	1.96	1.20	1	M	14	25+	8	3	2
	ANN.	52.9M	35.1	44.0M	-1.3	7859B	346B	90	JUL	-25	JAN	1	80	142	30	37.36	8.53	2.12	JUL	9.7M	25M	FEB	80	23	10

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NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

ANNUAL CLIMATOLOGICAL SUMMARY

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FEDERAL BUILDING
ASHEVILLE, NORTH CAROLINA
28801

STATION IDENTIFICATION

47065017 MANITOWOC WISCONSIN ELEVATION 660 FT. ABOVE SEA LEVEL LAT. 44 6N LONG. 87 41M

DATE		TEMPERATURE (°F)														PRECIPITATION (INCHES)								
												NUMBER OF DAYS								SNOW, SLEET			NO. OF DAYS		
YR	MO.	MEAN MAXIMUM	MEAN MINIMUM	MEAN	DEPART. FROM NORMAL	HEATING DEGREE DAYS	COOLING DEGREE DAYS	HIGHEST	DATE	LOWEST	DATE	MAX ≥ 90°	MAX ≤ 32°	MIN ≤ 32°	MIN ≤ 0°	TOTAL	DEPART. FROM NORMAL	GREATEST OBSERVED DAY	DATE	TOTAL FALL	MAX DEPTH	DATE	≥.10	≥.50	≥1.0
86	1	27.1	9.5	18.3	.0	1443	0	44	17	-11	27	0	20	31	7	.73	-.57	.25	25	2.5M	M		3	0	0
86	2	27.7	12.3	20.0	-1.9	1254	0	38	18	-6	13	0	20	28	5	2.12	.87	.44	5	6.0M	16	16	7	0	0
86	3	42.6	24.1	33.4	2.*	972	0	77	29	0	8	0	4	26	1	.52	-1.69	.28	18	M	M		2	0	0
86	4	55.1	37.8	46.5	2.9	548	0	73	29	25	22	0	0	8	0	1.89	-.93	.46	14	.01	01	30*	8	0	0
86	5	67.7	45.7	56.7	2.5	274	22	89	30	27	3	0	0	2	0	1.95	-.97	.65	16	.0	0		7	2	0
86	6	72.0	52.1	62.1	-1.8	126	47	84	27	39	2	0	0	0	0	6.16	3.02	1.28	4	.0	0		8	6	3
86	7	79.4	61.0	70.2	.5	17	185	94	18	48	3	3	0	0	0	5.92	2.72	2.20	25	.0	0		11	3	2
86	8	75.0	57.1	66.1	-2.7	38	76	81	16*	41	28	0	0	0	0	3.99	.88	1.07	17	.0	0		9	4	1
86	9	68.6	52.5	60.6	-.3	147	23	80	27	37	8	0	0	0	0	12.56	9.77	3.40	11	.0	0		11	9	3
86	10	58.1	41.9	50.0	-.3	457	0	71	20	32	15	0	0	1	0	2.44	.20	.80	12	.0	0		7	2	0
86	11	41.4	25.6	33.5	-3.4	938	0	58	1	3	13	0	4	25	0	1.65M	M	1.25	18	4.5	2	20	3	1	1
86	12	M	M	M				M		M		M	M	M	M	M	M			M	M		M	M	M
	ANN.	M	M	M	M	M	M	94M	JUL	M		3M	48M	121M	13M	M	M	3.40M	SEP	13.0M	16M	FEB	76M	27M	10M

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												NUMBER OF DAYS								SNOW, SLEET			NO. OF DAYS		
YR.	MO.	MEAN MAXIMUM	MEAN MINIMUM	MEAN	DEPART. FROM NORMAL	HEATING DEGREE DAYS	COOLING DEGREE DAYS	HIGHEST	DATE	LOWEST	DATE	MAX ≥ 90°	MAX ≤ 32°	MIN ≤ 32°	MIN ≤ 0°	TOTAL	DEPART. FROM NORMAL	GREATEST OBSERVED DAY	DATE	TOTAL FALL	MAX DEPTH	DATE	≥.10	≥.50	≥1.0
87	1	31.0	16.5	23.8	5.5	1269	0	42	14	-13	24	0	14	31	3	.71	-.59	.23	2	M	M		4	0	0
87	2	37.6	23.7	30.7	8.8	957	0	43	27+	0	9	0	2	26	1	.27	-.98	.22	22	.0M	0		1	0	0
87	3	44.7	31.8	38.3	7.4	821	0	70	7	19	31+	0	2	19	0	1.65	-.56	.90	1	.0M	0T	31+	4	1	0
87	4	56.6	40.5	48.6	5.0	486	0	72	18	25	4+	0	0	4	0	2.80	-.02	1.21	22	.0	0		5	3	1
87	5	68.2	47.5	57.9	3.7	239	24	84	9	38	13	0	0	0	0	2.88	-.04	.80	19	.0	0		9	2	0
87	6	79.8	58.4	69.1	5.2	30	161	97	14	42	4	2	0	0	0	1.51	-1.63	.70	21	.0	0		4	1	0
87	7	M	M	M				M		M		M	M	M	M	M	M			M	M		M	M	M
87	8	76.4	60.9	68.7	-.1	23	143	90	3+	46	24	2	0	0	0	4.77	1.66	1.20	9	.0	0		9	4	1
87	9	70.6	53.2	61.9	1.0	105	20	84	27	41	25	0	0	0	0	5.43	2.64	1.06	17	.0	0		9	5	1
87	10	55.2	36.5	45.9	-4.4	585	0	68	4	26	29	0	0	6	0	1.52	-.72	.32	17	.0	0		5	0	0
87	11	46.1	33.8	40.0	3.1	747	0	70	3	14	21	0	1	16	0	3.25	1.20	.62	29	.0	0		10	1	0
87	12	36.1M	24.2	30.2M	5.5	10688	08	48	9	12	19	0	8	28	0	2.23	.43	1.12	15	7.5M	7	15	4	1	1
	ANN.	M	M	M	M	M	M	M		-13	JAN	4M	27M	130M	4M		M	1.21M	APR	7.5M	7M	DEC	64M	18M	4M

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47065017 MANITOWOC WISCONSIN ELEVATION 660 FT. ABOVE SEA LEVEL LAT. 44 6N LONG. 87 41M

DATE		TEMPERATURE (°F)														PRECIPITATION (INCHES)										
												NUMBER OF DAYS								SNOW, SLEET			NO. OF DAYS		
YR.	MO.	MEAN MAXIMUM	MEAN MINIMUM	MEAN	DEPART. FROM NORMAL	HEATING DEGREE DAYS	COOLING DEGREE DAYS	HIGHEST	DATE	LOWEST	DATE	MAX ≥ 90°	MAX ≤ 32°	MIN ≤ 32°	MIN ≤ 0°	TOTAL	DEPART. FROM NORMAL	GREATEST OBSERVED DAY	DATE	TOTAL FALL	MAX DEPTH	DATE	≥.10	≥.50	≥1.0
80	1	25.4	8.7	17.1	-1.2	1482	0	47	30	-14	5	0	20	29	11	1.81	.51	1.00	20	8.8M	0		2	1	1
80	2	27.3	8.3	17.8	-4.1	1363	0	45	26+	-8	6	0	20	29	9	.58	-.67	.25	16	M	M		4	0	0
80	3	41.0	24.6	32.8	1.9	987	0	57	26+	11	21+	0	5	26	0	.66	-1.55	.20	28+	.0T	0T	31+	3	0	0
80	4	M	M	M				M		M		M	M	M	M	M	M			M	M		M	M	M
80	5	70.6	46.2	58.4	4.2	226	28	89	31	33	25	0	0	0	0	.99	-1.93	.44	9	.0	0		3	0	0
80	6	82.4	56.3	69.4	5.5	65	203	97	1	42	10+	12	0	0	0	.95	-2.19	.50	28	.0	0		2	1	0
80	7	81.5	63.0	72.3	2.6	8	240	98	8	48	1	6	0	0	0	2.72	-.48	.70	24+	.0	0		6	3	0
80	8	81.0	63.0	72.0	3.2	14	238	95	2	49	28	6	0	0	0	2.82	-.29	.73	23	.0	0		8	2	0
80	9	70.4	53.3	61.9	1.0	120	33	85	12	42	6	0	0	0	0	4.24	1.45	1.27	22	.0	0		8	2	1
80	10	53.7	36.4	45.1	-5.2	610	0	70	14	20	30	0	0	11	0	3.63	1.39	.90	23	.0	0		9	2	0
80	11	43.5	32.2	37.9	1.0	807	0	53	16	21	18	0	1	15	0	3.67	1.62	1.05	26	4.0	0		8	2	1
80	12	31.5	16.1	23.8	-.9	1270	0	52	6	0	29+	0	16	31	2	.82	-.98	.35	27	M	M		3	0	0
	ANN.	M	M	M	M	M	M	M		M		24M	62M	141M	22M		M	1.27M	SEP	12.8M	0M		56M	13M	3M

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												NUMBER OF DAYS								SNOW, SLEET			NO. OF DAYS		
YR.	NO.	MEAN MAXIMUM	MEAN MINIMUM	MEAN	DEPART. FROM NORMAL	HEATING DEGREE DAYS	COOLING DEGREE DAYS	HIGHEST	DATE	LOWEST	DATE	MAX ≥ 90°	MAX ≤ 32°	MIN ≤ 32°	MIN ≤ 0°	TOTAL	DEPART. FROM NORMAL	GREATEST OBSERVED DAY	DATE	TOTAL FALL	MAX DEPTH	DATE	≥.10	≥.50	≥1.0
89	1	34.9	21.0	28.0	9.7	1142	0	52	31	6	9+	0	10	30	0	.36M	M	.25	12	M	M		2	0	0
89	2	23.4	7.6	15.5	-6.4	1379	0	43	1	-9	5+	0	22	28	8	.87M	M	.42	13	13.0	M		3	0	0
89	3	34.4	18.9	26.7	-4.2	1182	0	64	27	3	19+	0	14	27	0	2.13M	M	.88	17	12.1M	0T	31+	3	3	0
89	4	50.0	33.0	41.5	-2.1	699	0	65	25	11	9	0	0	10	0	1.79	-1.03	.72	8	.0T	0T	30+	5	1	0
89	5	62.4	42.7	52.6	-1.6	377	1	78	23+	26	6	0	0	3	0	4.54	1.62	2.08	25	.0	0		4	2	2
89	6	71.9	53.1	62.5	-1.4	107	39	84	23	44	5+	0	0	0	0	.80	-2.34	.26	26	.0	0		2	0	0
89	7	79.0	60.6	69.8	.1	7	162	95	9	53	30+	2	0	0	0	3.99	.79	1.60	3	.0	0		4	2	2
89	8	78.7	59.3	69.0	.2	18	152	90	4+	49	7	2	0	0	0	.80	-2.31	.29	22	.0	0		2	0	0
89	9	69.6	49.6	59.6	-1.3	181	26	79	8+	32	24	0	0	1	0	1.26	-1.53	.70	9	.0	0		3	1	0
89	10	56.6	40.5	48.6	-1.7	505	0	72	14	28	22+	0	0	7	0	2.95	.71	.90	5	.0T	0T	31+	6	2	0
89	11	40.8	26.2	33.5	-3.4	938	0	55	11	8	24	0	5	20	0	1.17	-.88	.37	4	.0M	0T	30+	5	0	0
89	12	20.7	6.5	13.6	-11.1	1587	0	40	1	-20	21	0	25	31	8	.13M	M	.10	29	3.1M	6	14	1	0	0
	ANN.	51.9	34.9	43.4	-1.9	8122	380	95	JUL	-20	DEC	4	76	157	16	M	M	2.08	MAY	28.2M	6M	DEC	40	11	4

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47065017 MANITOWOC WISCONSIN ELEVATION 660 FT. ABOVE SEA LEVEL LAT. 44 6N LONG. 87 41W

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90	1	36.6	21.2	28.9	10.6	1110	0	46	17	10	31+	0	5	29	0	.81M	M	.26	24	2.0M	M		3	0	0
90	2	34.0	17.6	25.8	3.9	1093	0	48	13	-1	25	0	14	28	1	.86	-.39	.35	16	9.5M	M		4	0	0
90	3	M	M	M				M		M		M	M	M	M	M	M			M	M		M	M	M
90	4	54.8	35.9	45.4	1.8	591	7	85	26+	20	6	0	0	12	0	1.80	-1.02	.52	10	.0T	0T	30+	6	1	0
90	5	60.9	42.2	51.6	-2.6	408	2	82	8	32	10	0	0	1	0	3.09	.17	.85	10	.0	0		6	4	0
90	6	72.6	53.8	63.2	-.7	113	63	88	30	37	4	0	0	0	0	5.71	2.57	1.75	17	.0	0		9	3	3
90	7	77.7	59.3	68.5	-1.2	26	142	92	4	51	31+	1	0	0	0	2.40	-.80	1.50	29	.0	0		3	2	1
90	8	75.3	59.2	67.3	-1.5	29	105	92	27	48	7	1	0	0	0	3.24	.13	.79	19	.0	0		8	3	0
90	9	71.9	54.5	63.2	2.3	129	80	91	4	38	23	1	0	0	0	4.27	1.48	1.95	14	.0	0		7	3	1
90	10	55.8	39.9	47.9	-2.4	522	0	75	5	29	26+	0	0	5	0	2.71	.47	.75	10	.0	0		8	2	0
90	11	48.7	32.4	40.6	3.7	724	0	71	2	20	8	0	1	19	0	2.42	.37	.65	27+	.0	0		6	2	0
90	12	31.4	17.0	24.2	-.5	1260	0	48	9	-13	26	0	12	28	7	2.37	.57	1.03	3	10.0M	10	3	4	1	1
	ANN.	M	M	M	M	M	M	92	AUG+	M		3M	32M	122M	8M		M	1.95M	SEP	21.5M	10M	DEC	64M	21M	6M

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DATE		TEMPERATURE (°F)															PRECIPITATION (INCHES)									
												NUMBER OF DAYS								SNOW, SLEET			NO. OF DAYS		
YR.	MO.	MEAN MAXIMUM	MEAN MINIMUM	MEAN	DEPART. FROM NORMAL	HEATING DEGREE DAYS	COOLING DEGREE DAYS	HIGHEST	DATE	LOWEST	DATE	MAX ≥ 90°	MAX ≤ 32°	MIN ≤ 32°	MIN ≤ 0°	TOTAL	DEPART. FROM NORMAL	GREATEST OBSERVED DAY	DATE	TOTAL FALL	MAX DEPTH	DATE	≥.10	≥.50	≥1.0
91	1	23.7	9.4	16.6	-1.7	1493	0	38	19	-12	25	0	27	31	7	.90	-.40	.42	5	4.0	11	11	2	0	0
91	2	33.8	19.2	26.5	4.6	1074	0	48	8	1	16	0	12	26	0	.60	-.65	.24	23	2.0M	M		3	0	0
91	3	40.9	26.9	33.9	3.0	957	0	65	27	12	4+	0	3	23	0	2.74	.53	.92	2	.0T	0T	31+	9	2	0
91	4	55.1	37.5	46.3	2.7	559	4	85	6	26	2	0	0	7	0	3.04	.22	1.05	14+	3.0	0		7	2	2
91	5	68.5	49.0	58.8	4.6	232	46	87	14	34	3	0	0	0	0	2.74	-.18	.88	26	.0	0		8	2	0
91	6	77.9	57.7	67.8	3.9	30	120	95	29	41	5	2	0	0	0	.83	-2.31	.76	15	.0	0		1	1	0
91	7	78.5	61.3	69.9	.2	17	177	92	6	51	27	1	0	0	0	8.12	4.92	2.19	28	.0	0		9	6	4
91	8	78.7	61.1	69.9	1.1	18	179	91	26	47	6	1	0	0	0	2.22	-.89	1.40	8	.0	0		4	1	1
91	9	67.8	51.5	59.7	-1.2	224	71	88	9	31	28+	0	0	2	0	2.36	-.43	.75	3	.0	0		6	1	0
91	10	55.4	40.3	47.9	-2.4	525	0	69	2	26	19	0	0	5	0	5.57	3.33	1.60	25	.0	0		8	5	1
91	11	38.0	24.7	31.4	-5.5	1004	0	51	30+	4	7	0	9	23	0	2.94	.89	.59	1	1.5	2	5	8	3	0
91	12	32.7	20.0	26.4	1.7	1191	0	46	12	2	16+	0	13	30	0	2.27	.47	1.00	5	1.5M	2	21+	4	2	1
	ANN.	54.2	38.2	46.3	.9	7324	597	95	JUN	-12	JAN	4	64	147	7	34.33	5.50	2.19	JUL	12.0M	11M	JAN	69	25	9

M MISSING DATA. APPEARS WITH MONTHLY DATA WHEN LESS THAN 10 DAYS ARE MISSING, AND IT APPEARS ALONE IF 10 OR MORE DAYS ARE MISSING. IT APPEARS WITH ANNUAL DATA, WHEN DERIVED FROM MONTHS WITH MISSING DATA.

+ OCCURRED ON ONE OR MORE PREVIOUS DATES DURING THE MONTH.

T TRACE

V INCLUDES TOTAL FOR PREVIOUS MONTH.

B ADJUSTED MONTHLY OR ANNUAL VALUE TOTAL CONTAINS ESTIMATED VALUE(S) FOR MISSING DATA.

A AMOUNT PRECIPITATION MAY INCLUDE PRECIPITATION THAT OCCURRED DURING THE PREVIOUS MONTHS.

U.S. DEPARTMENT OF COMMERCE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

ANNUAL CLIMATOLOGICAL SUMMARY

NATIONAL CLIMATIC DATA CENTER
FEDERAL BUILDING
ASHEVILLE, NORTH CAROLINA
28801

STATION IDENTIFICATION

47065017 MANITOWOC WISCONSIN ELEVATION 660 FT. ABOVE SEA LEVEL LAT. 44 6N LONG. 87 41H

DATE		TEMPERATURE (°F)														PRECIPITATION (INCHES)									
												NUMBER OF DAYS								SNOW, SLEET			NO. OF DAYS		
YR.	MO.	MEAN MAXIMUM	MEAN MINIMUM	MEAN	DEPART. FROM NORMAL	HEATING DEGREE DAYS	COOLING DEGREE DAYS	HIGHEST	DATE	LOWEST	DATE	MAX ≥ 90°	MAX ≤ 32°	MIN ≤ 32°	MIN ≤ 0°	TOTAL	DEPART. FROM NORMAL	GREATEST OBSERVED DAY	DATE	TOTAL FALL	MAX DEPTH	DATE	≥.10	≥.50	≥1.0
92	1	30.1	19.5	24.8	6.5	1240	0	40	12	-9	16	0	12	29	4	.76	-.54	.20	2	.0M	2	20+	4	0	0
92	2	34.0	22.4	28.2	6.3	1061	0	44	2	4	9	0	7	29	0	1.24	-.01	.56	15	6.0M	5	16+	3	1	0
92	3	38.2	24.5	31.4	.5	1035	0	56	1	8	13+	0	8	24	0	2.19	-.02	1.00	9	.0M	3	10+	7	2	1
92	4	46.0	34.1	40.1	-3.5	742	0	57	7	22	2	0	1	12	0	2.77	-.05	.75	16	.0M	1	13+	7	2	0
92	5	64.5	43.7	54.1	-.1	337	6	84	2+	31	5	0	0	2	0	.79	-2.13	.31	12	.0	0		3	0	0
92	6	69.3	51.9	60.6	-3.3	163	38	88	13	38	21	0	0	0	0	1.53	-1.61	.36	19	.0	0		7	0	0
92	7	73.3	56.7	65.0	-4.7	48	56	83	9+	46	21	0	0	0	0	4.72	1.52	2.39	12	.0	0		7	3	1
92	8	73.6	55.0	64.3	-4.5	79	64	87	10	47	29+	0	0	0	0	2.63	-.48	1.46	8	.0	0		5	1	1
92	9	64.8	49.5	57.2	-3.7	233	4	74	17+	33	29	0	0	0	0	4.56	1.77	1.45	18	.0	0		9	3	2
92	10	54.9	39.9	47.4	-2.9	541	3	81	2	22	19	0	0	7	0	1.23	-1.01	.60	16	.0M	0		4	1	0
92	11	39.2	29.1	34.2	-2.7	919	0	53	2	18	28+	0	4	19	0	5.39	3.34	2.10	2	1.0M	2	7	11	3	1
92	12	31.8	19.7	25.8	1.1	1211	0	41	16	-2	24	0	11	28	2	2.10	.30	.55	15	4.0M	4	12+	4	1	0
	ANN.	51.6	37.2	44.4	-.9	7609	171	88	JUN	-9	JAN	0	43	150	6	29.91	1.08	2.39	JUL	11.0M	5	FEB	71	17	6

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